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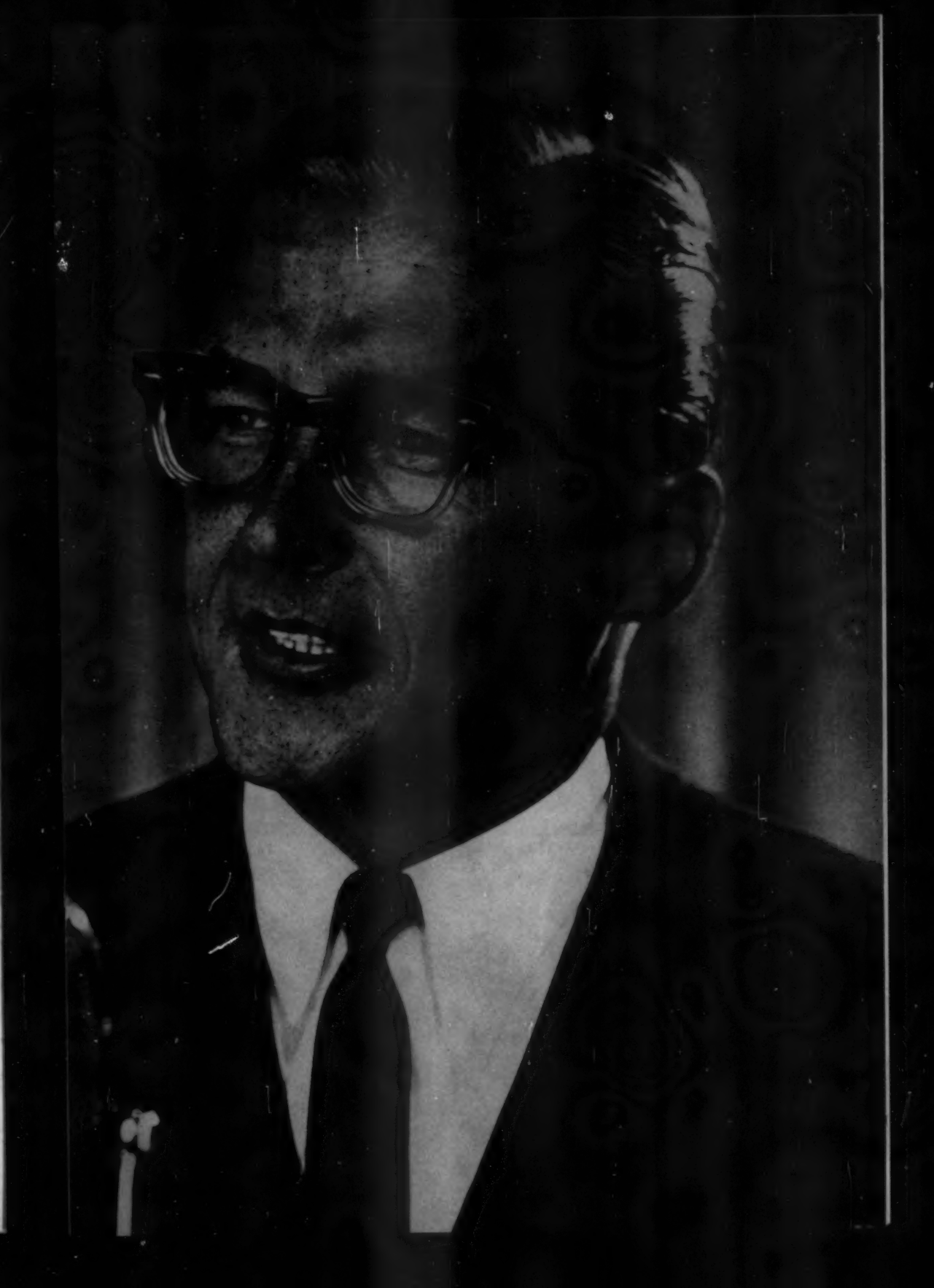

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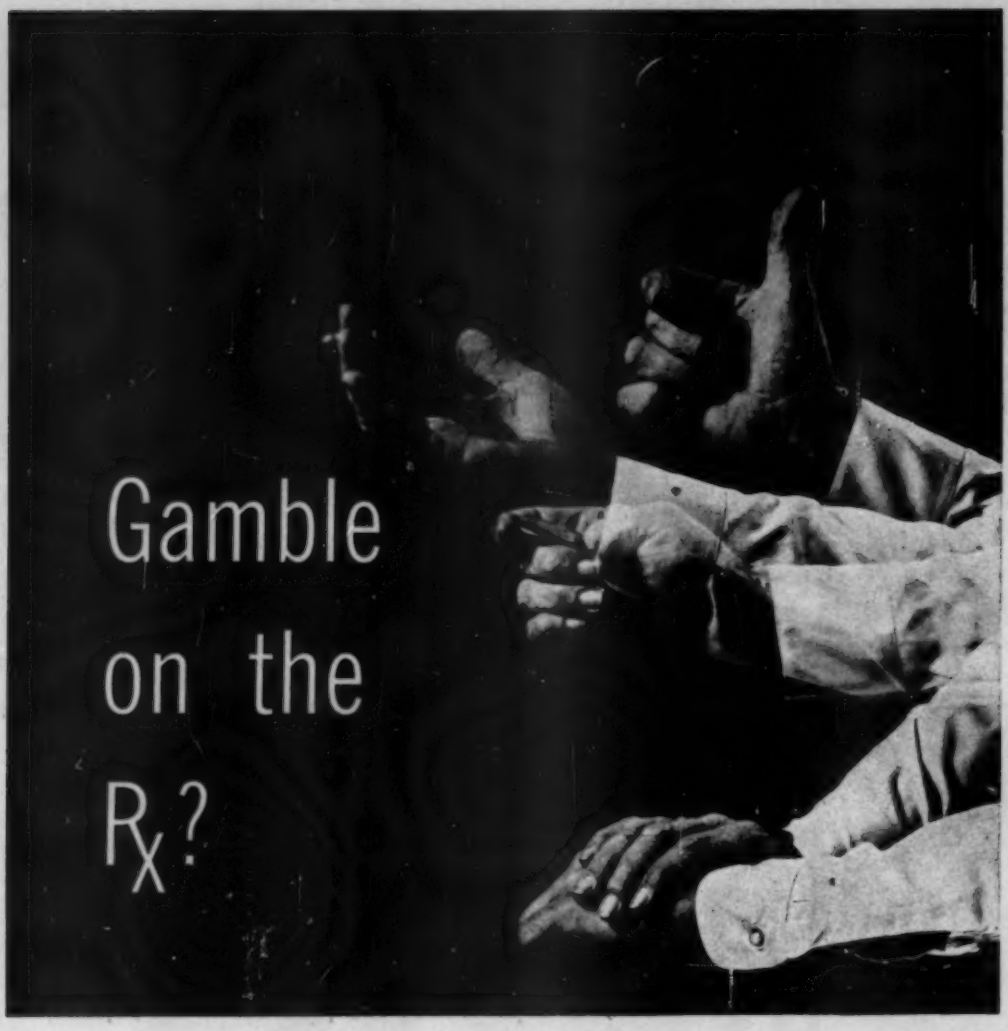


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**TRADEMARK, HEADQUARTERS, AND EFFICIENCY.** Of course, this, too, was the year we changed our trademark and presented it to you as "a new mark of optical leadership." We have also proceeded with the consolidation of our administrative offices, financial, engineering and related services into a headquarters building in Rochester, New York. We have made many other moves that will be apparent only in our increased efficiency. How does it all add up? Proper and capable management of the assets and resources available to us in greater amounts than ever before, through our affiliation with Textron, and an opportunity to provide you with the broadest possible base from which to serve your patients. The consistently gratifying confidence you've shown in Shuron has never been higher. The near future affords even greater opportunities for us to build this confidence to unprecedented levels—and, we intend to take full advantage of them!

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# Shuron

ROY MARKS
President, Shuron Optical Company

# 1961 PROGRESS REPORT

In a very real sense, *you* are the best judge of our activities during the last year. As a manufacturer, our success or failure depends on how well we designed and produced products to make your job less complicated, more efficient, and more satisfying. During the year, we feel we have made headway in a number of areas. I would like to review this progress with you:

**INSTRUMENTS AND EQUIPMENT.** During 1961, Shuron re-entered the ophthalmic equipment field. Our first product, the Monitor 505 Projector, has been well accepted. Our purpose was to design a projector more convenient for the practitioner to use in every way. According to reports, we have accomplished this purpose with gratifying results. In 1961, we were also proud to announce the availability of Welch Allyn diagnostic instruments through our distributors. Shuron's next development in the equipment field, scheduled for September 1962, is an ophthalmic unit, complete with chair and stand, which you will find just as revolutionary and practical.

**LENSES.** In the last year, Shuron activated a new 3.3 million dollar lens plant, the most modern in the world, and purchased Modern Optics, a leading manufacturer of high quality multifocal lenses. The Modern multifocal operation has been transferred to the new plant, completing the centralization of our lens-making facilities. In terms of benefits to you, we can now offer the consistently high quality of single vision and multi-vision lenses that you want for your patients. The new lens plant also lays the groundwork for lens products that actually cannot be manufactured in *any* plant but the type we have built! Definitely scheduled for next year is a line of industrial 3mm lenses, and new multifocal designs.

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Vol. 38 December, 1961 No. 12

# SPATIAL RELATIONSHIPS BETWEEN THE EYES, THE NOSE, AND THE RIMS OF THE ORBITS*

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Columbus, Ohio

## INTRODUCTION

The purpose of this research was to investigate the spatial relationships that exist between the eyes, the nose and the rims of the orbits.

A splay meter described by Fry[1] was used in this study and will be discussed in the following section. This device produces illuminated contour lines on the face which represent sections of the face inclined at an angle of six degrees to the face plane, which is defined as the plane tangent to the chin and the two superciliary ridges.[2] The device is also equipped with a camera which has its axis inclined at an angle of 96° to the face plane and which takes an orthographic photograph of the face. A full scale photograph of the subject produced in this way makes it possible to obtain the following spatial dimensions: the interpupillary distance; the slope angle of the nose; the distance from the pupillary center to the bridge of the nose; the breadth of the nose; the corneal inset; the splay angle and the crest angle of the nose. The first four values are direct measurements taken from the photograph, whereas the latter three are computed from linear distances measured on the photograph.

These measurements vary from individual to individual, and one purpose of this study was to gather information about these variations. Another purpose of this study was to evaluate how closely these variables are related to each other. Of particular interest was the variation from individual to individual in the slope and the splay angles of the nose. This is important because these angles affect the position and the angling of the spectacle pads resting on the nose. For a frame to be properly fitted each pad must be tangent at its center to the side of the nose.

The degree of prominence of the cheek and the superciliary ridges with relation to the corneal poles can be determined from the photo-

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This article is based upon a thesis submitted by the author in partial fulfillment of the requirements for the degree Master of Science in Physiological Optics, The Ohio State University, June, 1959.

†Optometrist. M.Sc.

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Fig. 2. Photograph Obtained with the Splay Meter. The region centered on each of the two pupils has been given normal exposure in the printing operation to give a usable image of the pupil and the remainder has been over-exposed to bring out the contour bands.

graph. Information of this type, along with information about the nose, can be used to evaluate the effect of these structures on the extent of the monocular field of fixation and the monocular field of view. This kind of information can also help in designing the shape of a lens to be worn before the eye and its placement with respect to the eyebrow, nose and cheek.

APPARATUS

The splay meter used in this investigation is shown in Figure 1.

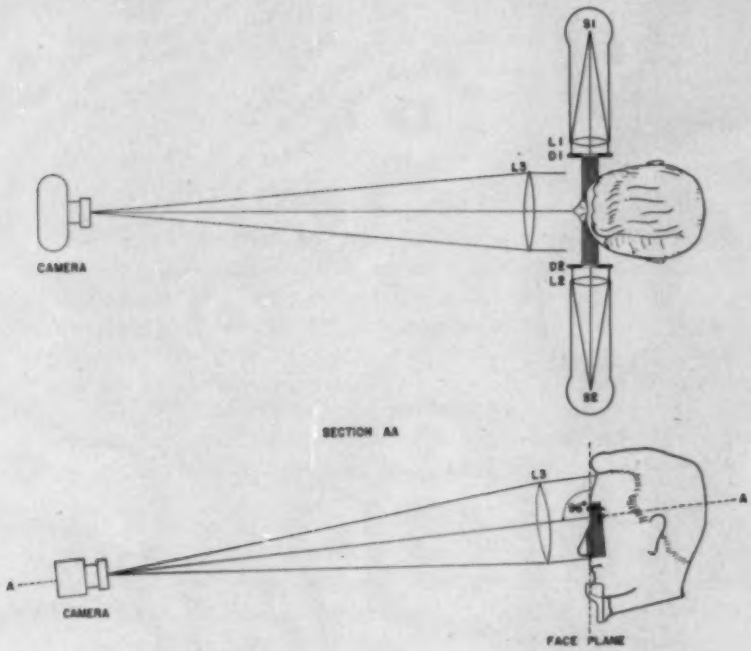



Fig. 1. Diagram of the Splay Meter.

The method of producing light streaks on the face to obtain illuminated contour bands is shown in Figure 1. The lens $L_1$ collimates the light from the point source $S_1$ and the collimated rays are transmitted through parallel slits in the diaphragm $D_1$. Each slit, and the rays transmitted through it, lie in a plane parallel to the spectacle plane. Therefore, the bright lines or contour bands on the face represent sec-

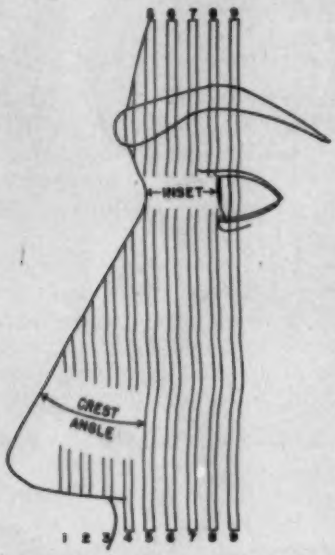



Fig. 4. Profile of the Face Obtained from Direct Measurements on the Photograph Obtained with the Splay Meter. The corneal inset and the crest angle of the nose are shown.

This made it possible to compute the corneal inset, i.e., the distance from the eyes to the plane tangent to the root of the nose. This measurement was reckoned from the corneal pole, and allowance, therefore, was made for the corneal vertex depth and that portion of band number 9 which fell behind the limbus.

In computing the corneal vertex depth, values of 7.8 mm. and 12.0 mm. were used for the radius of the cornea and the horizontal chord of the cornea respectively.[3, 4] These values yield a value of 2.3 mm. for the corneal vertex depth. This was the standard allowance in each case.

In Figure 3, the corneal inset is given by the distance from contour band number 5 to band number 9, minus the corneal vertex depth allowance. Band number 9 is the most remote band: and the plane corresponding to band number 5 grazes the root of the nose.

The corneal inset is readily seen in Figure 4, where it represents the linear distance from band number 5 to band number 9, minus the corneal vault allowance. It is given by n, the number of cycles, times the interval of the cycle I, minus 2.3 mm. for the corneal vertex depth, or:

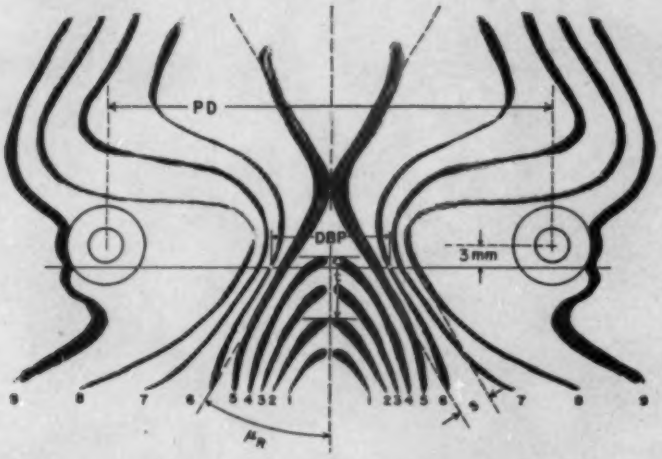
tions of the face parallel to the spectacle plane. The sheets of rays from the two sources coalesce precisely. The slits are placed 3.33 mm. apart from center to center. The head is adjusted by means of a chin and brow rest so that the face plane is 6° from the spectacle plane.

The axis of the camera coincides with the axis of the lens $L_2$ and is normal to the spectacle plane. The secondary focal point of the lens $L_2$ falls at the entrance pupil of the camera so that the picture represents an orthographic projection of the face. If a full scale enlargement is made from the negative, one can measure distances directly. A typical photograph of a subject produced in this way is shown in Figure 2. The region centered on each of the two pupils has been given normal exposure in the printing operation to give a usable image of the pupil and the remainder has been over-exposed to bring out the contour bands.

## PROCEDURE

The illuminated contour pattern in Figure 2 is schematically represented in Figure 3. The latter figure will be used to identify the spatial relationships of interest here, and to describe the method used to secure the necessary measurements.

The head of the subject was adjusted so that the most remote contour band, band number 9, Figure 4, falls at the limbus on each eye.




SCHEMATIC OF ILLUMINATION PATTERN ON PHOTOGRAPH

Fig. 3. Schematic Diagram of the Illuminated Contour Pattern of the Photograph Obtained with the Splay Meter.

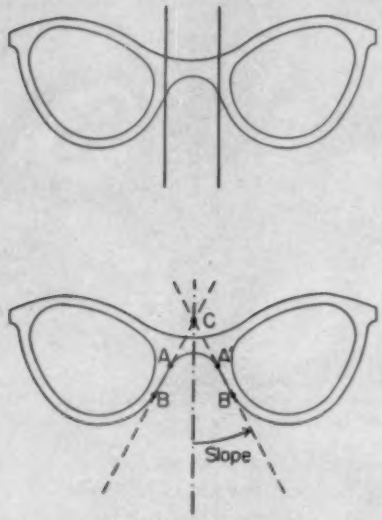



Fig. 5. Diagram of the Front of a Zylonite Spectacle Frame. In the top figure, the two parallel lines are in contact with the front side of the frame, and define the spectacle plane. In the lower figure, the points A and B represent the top and bottom of the right pad, and A′ and B′ the corresponding points for the left pad. This figure illustrates the slope angle of the pads.

The tangent of the splay angle can be obtained from the photograph. It represents the distance between two contour bands, that is perpendicular to the grazing band, divided by the actual distance between the corresponding sheets of rays. In Figure 3, the distance between contour bands (s) measured 4.8 mm., and the distance between the corresponding sheets of rays represents 3 cycles. The tangent of the splay angle is given by the value of s, divided by the number of cycles n, times the interval I, or:

$$\tan \text{ (splay angle)} = \frac{s}{nI} = \frac{4.8 \text{ mm.}}{3 \times 3.33 \text{ mm.}}.$$

Therefore the splay angle in this case is 25.7°.

The spectacle frame counterpart of the splay angle of the nose can be defined as the angle formed by a plane, tangent to the center of the pad, and a line normal to the spectacle plane.[5] The splay angle of the spectacle frame is illustrated in Figure 6.

If a spectacle frame is properly fitted the pad will be tangent at its center to the side of the nose. Consequently, we have defined splay

$$\text{Corneal inset} = nI - 2.3 \text{ mm.}$$

In Figure 4, this value is:

$$\text{Corneal inset} = (4 \times 3.33 \text{ mm.}) - 2.3 \text{ mm.}$$
$$= 11.0 \text{ mm.}$$

It was desirable to know the breadth of the nose, which is the distance between two points, one on each side of the nose, 3 mm. behind the grazing sheet of rays and 3 mm. below the level of the pupillary centers. This value was measured directly from the photograph, and is labeled DBP in Figure 3.

The abbreviation DBP means distance between pads, and is an important dimension in the design of eyewear. The location of the pad points is arbitrary, based on the assumption that the centers of the pads rest on points which lie 3 mm. below the major reference points and 3 mm. behind the plane which grazes the root of the nose.[1, 2] A study of photographs taken with the splay meter in which the subjects wore their spectacle frames confirmed that eyewear is actually being fitted to conform to this assumption.*

The position and angling of the pads on the spectacle frame are illustrated in Figure 5. In the top figure, the two parallel lines are in contact with the front side of the zylonite frame, and define the spectacle plane. The center of the pad would be a point midway between the top and bottom and 6 mm. behind the spectacle plane. In the lower figure, the points A and B represent the top and bottom of the right pad, and A′ and B′, the corresponding points for the left pad.

The section of rays grazing the root of the nose yields lines on the sides of the nose that are reasonably straight. These lines can be used to measure the slope angles. In Figure 3, the grazing sheet of rays is contour band number 5, and the slope angle of the right side of the nose is $\mu_R$.

The spectacle frame counterpart of the slope angle of the nose is seen in Figure 5. The slope angle of the frame is that angle between the line which is tangent to the eye wire at the center of the pad and the vertical midline of the frame.[3]

This yields one of the two parameters which describes uniquely the orientation of the side of the nose at the reference point. The other parameter, called the splay, will now be defined. It is the angle between the plane tangent to the nose at the pad point and a line normal to the spectacle plane.

---

*In the picture the pad points are assumed to lie 3 mm. below the pupillary centers because the primary lines of sight are parallel to the axis of the lens $L_3$ when the picture is taken. When the primary lines of sight are directed straight ahead as in fitting glasses for use at distance the pad points may be assumed to fall 6 mm. below the centers of the pupils or 3 mm. below the major reference points of the spectacle lenses.

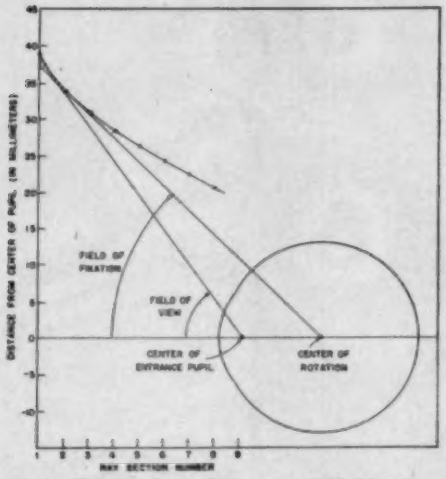



Fig. 7. Section of the Eye and Nose Along the 205° Meridian. Diagram illustrating the extent of the field of fixation and the field of view along the 205° meridian.

The same procedure can be followed to determine the extent of the monocular visual field, except that the entrance pupil is used instead of the center of rotation of the eye. (See Figure 7.) The entrance pupil of the eye was taken to be 3.0 mm. behind the corneal pole.[2]

RESULTS

The 92 subjects in this study were drawn from students and members of the staff of the Ohio State University School of Optometry and from patients admitted to the Optometry Clinic. The subjects were white and ranged in age from 17 to 30 years. Sixty-three of the subjects were males and 29 were females.

The mean value, the standard deviation, and the range for each of the six dimensions are reported in Table 1, which includes a breakdown of the data for males and females.

The coefficient of correlation was computed for all possible pairs of the six basic dimensions to determine the degree of relationship between specific pairs. These correlation values were computed separately for males and females and are reported in Table 2.

To investigate asymmetry, dimensions with bilateral components were compared to each other. The measure of asymmetry is reported in terms of delta ($\Delta$) values, indicating the difference between right and left components. The frequency of specific delta values for the slope angle, the splay angle, and the pad point to pupil are reported in

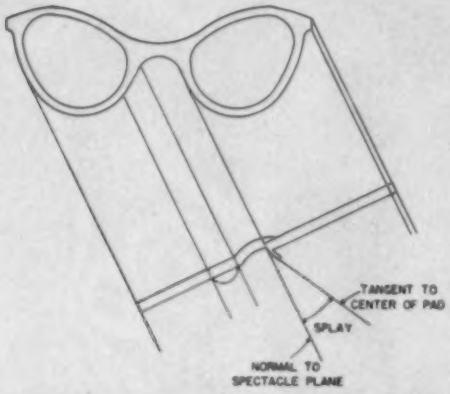



Fig. 6. Diagram Illustrating the Splay Angle on a Spectacle Pad. The lower drawing is an orthographic projection of the frame in which the dihedral edge between the pad and the front surface of the frame is normal to the drawing.

and slope angles of the nose that correspond to the splay and slope angles of a pair of pads on the spectacle frame.

Following the same procedure used to find the splay angle, the crest angle of the nose can be found. In fact, a complete profile of the nose can be plotted, as shown in Figure 4, from the data obtained from the photograph. The crest angle is the angle that the crest of the nose makes with the spectacle plane.

The interpupillary distance was measured directly from the photograph since the subject had been instructed to look at the center of the camera lens. This is labeled P.D. on Figure 3.

An objective method can be used to determine the extent to which the nose, the brow, and the cheeks limit the monocular field of fixation and the monocular field of view. The procedure is essentially the same as that used to plot the profile of the nose.

To determine the extent of the field of fixation in a specific meridian, a direct measurement was made on the photograph from the pupillary center along that meridian to the center of each contour band. The values thus obtained were plotted on a graph as shown in Figure 7.

Figure 7 is a plot of the left eye of the subject in Figure 3, and represents the 205° meridian. A line drawn tangent to the surface of the nose and through the center of rotation of the eye represents the angular extent of the field of fixation from the straight ahead position. The center of rotation was taken to be 13.0 millimeters behind the corneal pole.[2] The straight ahead position was the position the subject maintained when the photograph was taken.

Tables 3, 4, and 5, respectively. These tables include a breakdown into sex groups and a breakdown indicating the side of the face with the larger component.

TABLE 3

Asymmetry of the Slope Angle

| | —Male Subjects— (63) | | | – Female Subjects – (29) | | | — All Subjects — (92) | | |
|---|---|---|---|---|---|---|---|---|---|
| Δu | Freq. | Larger u | | Freq. | Larger u | | Freq. | Larger u | |
| | | $u_R$ | $u_L$ | | $u_R$ | $u_L$ | | $u_R$ | $u_L$ |
| 0 | 23 | — | — | 10 | — | — | 33 | — | — |
| 0.5° | 1 | 1 | — | — | — | — | 1 | 1 | — |
| 1.0° | 11 | 5 | 6 | 8 | 7 | 1 | 19 | 12 | 7 |
| 1.5° | 1 | 1 | — | — | — | — | 1 | 1 | — |
| 2.0° | 12 | 7 | 5 | 4 | 4 | — | 16 | 11 | 5 |
| 2.5° | — | — | — | — | — | — | — | — | — |
| 3.0° | 3 | 2 | 1 | — | — | — | 3 | 2 | 1 |
| 3.5° | — | — | — | 1 | 1 | — | 1 | 1 | — |
| 4.0° | 4 | 3 | 1 | 1 | 1 | — | 5 | 4 | 1 |
| 5.0° | 2 | 1 | 1 | 2 | 2 | — | 4 | 3 | 1 |
| 6.0° | 1 | 1 | — | 2 | 2 | — | 3 | 3 | — |
| 7.0° | 3 | 2 | 1 | — | — | — | 3 | 2 | 1 |
| 10.0° | 1 | 1 | — | 1 | 1 | — | 2 | 2 | — |
| 10.5° | 1 | 1 | — | — | — | — | 1 | 1 | — |
| | — | — | — | — | — | — | — | — | — |
| Total | 63 | 25 | 15 | 29 | 18 | 1 | 92 | 43 | 16 |

TABLE 4

Asymmetry of the Splay Angle

| | —Male Subjects— (63) | | | – Female Subjects – (29) | | | — All Subjects — (92) | | |
|---|---|---|---|---|---|---|---|---|---|
| Δ | Freq. | Larger | | Freq. | Larger | | Freq. | R Larger | L |
| | | R | L | | R | L | | | |
| 0 | 12 | — | — | 6 | — | — | 18 | — | — |
| 1° | 9 | 6 | 3 | 2 | 2 | — | 11 | 8 | 3 |
| 2° | 8 | 3 | 5 | 1 | — | 1 | 9 | 3 | 6 |
| 3° | 5 | 2 | 3 | 5 | 5 | — | 10 | 7 | 3 |
| 4° | 6 | 5 | 1 | 6 | 3 | 3 | 12 | 8 | 4 |
| 5° | 4 | 2 | 2 | 4 | 4 | — | 8 | 6 | 2 |
| 6° | 1 | 1 | — | 1 | 1 | — | 2 | 2 | — |
| 7° | 7 | 5 | 2 | 2 | 2 | — | 9 | 7 | 2 |
| 8° | 3 | 2 | 1 | 1 | 1 | — | 4 | 3 | 1 |
| 9° | 4 | 4 | — | 1 | 1 | — | 5 | 5 | — |
| 10° | 1 | 1 | — | — | — | — | 1 | 1 | — |
| 11° | 2 | 1 | 1 | — | — | — | 2 | 1 | 1 |
| 12° | 1 | 1 | — | — | — | — | 1 | 1 | — |
| | — | — | — | — | — | — | — | — | — |
| Total | 63 | 33 | 18 | 29 | 19 | 4 | 92 | 52 | 22 |

## DISCUSSION AND CONCLUSIONS

In order to analyze the data it was necessary to designate an arbitrary point on each side of the nose which would correspond to the center of the pad on a spectacle frame. After such a point on the nose

TABLE 1

The Range, Mean, and Standard Deviation for the Variables Included in This Study

| | All Subjects (92) | | | Male Subjects (63) | | | Female Subjects (29) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Range | M | $\sigma$ | Range | M | $\sigma$ | Range | M | $\sigma$ |
| Slope | 10.0 to 34.0° | 20.7 | 4.7 | 10.0 to 29.0 | 20.3 | 4.4 | 15.0 to 34.0 | 21.6 | 5.2 |
| Splay | 6.0 to 35.0° | 22.7 | 4.9 | 6.0 to 35.0 | 21.8 | 5.1 | 16.9 to 33.9 | 24.4 | 3.8 |
| Crest | 17.5 to 52.9° | 35.0 | 7.1 | 21.2 to 52.9 | 36.0 | 6.0 | 17.5 to 47.8 | 32.6 | 8.5 |
| P.D. | 57.0 to 74.5mm | 64.1 | 3.2 | 58.5 to 74.5 | 65.3 | 2.7 | 57.0 to 67.0 | 61.4 | 2.5 |
| Corneal Inset | 7.0 to 19.5mm | 13.6 | 2.3 | 10.7 to 19.0 | 14.0 | 1.9 | 7.0 to 19.5 | 12.8 | 2.8 |
| D.B.P. | 12.0 to 21.0mm | 15.6 | 1.9 | 12.0 to 20.0 | 15.8 | 1.9 | 12.5 to 21.0 | 15.1 | 1.8 |

TABLE 2

The Coefficient of Correlations for the Variables Included in this Study

| | | Male Subjects (63) | Female Subjects (29) |
|---|---|---|---|
| Slope | Splay | +0.35 | +0.04 |
| Slope | Crest | +0.04 | +0.20 |
| Slope | P.D. | +0.02 | +0.20 |
| Slope | C.I. | −0.08 | −0.01 |
| Slope | D.B.P. | +0.05 | +0.42 |
| Splay | Crest | −0.20 | −0.14 |
| Splay | P.D. | +0.30 | −0.02 |
| Splay | C.I. | −0.16 | +0.02 |
| Splay | D.B.P. | −0.06 | +0.02 |
| Crest | P.D. | −0.06 | +0.05 |
| Crest | C.I. | −0.18 | −0.49 |
| Crest | D.B.P. | +0.28 | +0.62 |
| P.D. | C.I. | +0.09 | +0.17 |
| P.D. | D.B.P. | +0.36 | +0.20 |
| C.I. | D.B.P. | +0.02 | −0.22 |

FIGURE 8

Scattergram Relating Computed Crest Angle with Measured Crest Angle

| Measured Crest (degrees) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 52-55 | | | | | | 1 | | | | | |
| 48-51 | | | | | | | 1 | | 1 | | |
| 44-47 | | 1 | 1 | 3 | | 1 | 2 | | | | |
| 40-43 | | | | 1 | 4 | 1 | 2 | 1 | 3 | | |
| 36-39 | | 1 | | 3 | 1 | 9 | 6 | | 2 | 2 | 1 |
| 32-35 | | 1 | 3 | 2 | 4 | 4 | 4 | 1 | | | |
| 28-31 | 1 | | 1 | | 2 | 4 | 1 | | | | 1 |
| 24-27 | | 1 | | 3 | 4 | 1 | 1 | | | | |
| 20-23 | | | | | 2 | 1 | | | | | |
| 16-19 | | 1 | | | 1 | | | | | | |
| | 20<br>23 | 24<br>27 | 28<br>31 | 32<br>35 | 36<br>39 | 40<br>43 | 44<br>47 | 48<br>51 | 52<br>55 | 56<br>59 | 60<br>63 |

Computed Crest (degrees)

Fig. 8. Scattergram Relating Computed Crest Angle with Measured Crest Angle.

FIGURE 9

Scattergram Relating P.D. with D.B.P. for Male Subjects

| P.D. (mm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 74 | | | | | | 1 | | | | |
| 73 | | | | | | | | | | |
| 72 | | | | | | | | | | |
| 71 | | | | | | | | | | |
| 70 | | | | | | 1 | 1 | | | |
| 69 | | | | | 1 | 1 | | | | |
| 68 | | | | 4 | 2 | 2 | 1 | | | |
| 67 | | | | 1 | 3 | | | 2 | | |
| 66 | | 1 | 3 | 1 | 2 | | | 1 | | |
| 65 | | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | |
| 64 | | 2 | 1 | | 2 | 1 | | | | |
| 63 | | 1 | | 2 | 3 | 1 | | | | |
| 62 | | | 1 | | | 2 | | | | |
| 61 | | 1 | | | | 1 | | | | |
| 60 | 1 | 1 | | | | | | | | |
| 59 | | | | | | | | | | |
| 58 | | 1 | | | | | | | | |
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | |

D.B.P. (mm)

Fig. 9. Scattergram Relating P.D. with D.B.P. for Male Subjects.

TABLE 5

Asymmetry of Pad Point to Pupil

| Δ (mm) | —Male Subjects— (63) Freq. | Larger R | Larger L | – Female Subjects – (29) Freq. | Larger R | Larger L | — All Subjects — (92) Freq. | Larger R | Larger L |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 9 | — | — | 3 | — | — | 12 | — | — |
| 0.5 | 16 | 12 | 4 | 12 | 5 | 7 | 28 | 17 | 11 |
| 1.0 | 15 | 7 | 8 | 12 | 10 | 2 | 27 | 17 | 10 |
| 1.5 | 10 | 5 | 5 | — | — | — | 10 | 5 | 5 |
| 2.0 | 4 | 4 | — | 1 | — | 1 | 5 | 4 | 1 |
| 2.5 | 3 | 3 | — | — | — | — | 3 | 3 | — |
| 3.0 | 2 | 1 | 1 | 1 | 1 | — | 3 | 2 | 1 |
| 3.5 | 1 | 1 | — | — | — | — | 1 | 1 | — |
| 4.0 | 3 | 2 | 1 | — | — | — | 3 | 2 | 1 |
| Total | 63 | 35 | 19 | 29 | 16 | 10 | 92 | 51 | 29 |

was selected, it was necessary to describe the orientation of the surface of the nose at this point. The orientation can be described in terms of two independent parameters, the slope and the splay. In addition to describing the variations of this surface from individual to individual, it is important to know how closely these parameters are related to each other. Both parameters are important from the standpoint of spectacle frame design and fitting.

Regarding the first inquiry, i.e., the description of the sides of the nose, it was found that the range for all subjects for the slope was from 10.0 to 34.0°, with a mean of 20.7° and a standard deviation of 4.7°. The splay ranged from 6.0 to 35.0° with a mean of 22.7° and a standard deviation of 4.9°.

The mean values of the slope and splay for the female subjects were slightly higher than those found for the male subjects. (See Table 1.) To determine the significance between the female mean values and the male mean values, the standard error of the difference between means was computed. The results indicated that there is no significant difference between male and female values for slope and splay.

The same test of significance between means, i.e., between male and female mean values, was computed for the remaining dimensions. These results showed that only the interpupillary distance had mean values which were significantly different between males and females.

It would be possible to compute the crest angle from slope and splay if the crest of the nose were parallel to the dihedral edge between the planes tangent to the sides of the nose. The formula is as follows:

eye sizes and bridge sizes. The coefficient of correlation for these variables was computed to be +0.36 for males and +0.20 for females. The scatter diagrams in Figures 9 and 10 indicate the various combinations of eye sizes and bridge sizes required for the group of people used in this study.

The correlations between slope and splay, P.D. and D.B.P. are such that there would be little advantage in using various combinations of slope and splay for various combinations of P.D. and D.B.P. A single combination of slope and splay should suffice for all frames although no combination of slope and splay would be a proper fit for all people.

No efforts were made in this study to determine at what value the magnitude of nasal asymmetry commences to be consequential: but examination of Table 3 reveals that 90% of all subjects showed 5 degrees or less of slope asymmetry. Likewise, it can be seen in Table 4 that 73% of all subjects showed 5 degrees or less of splay asymmetry.

It had been determined experimentally and theoretically that the nasal asymmetry was not an artifact of the apparatus introduced by rotating the head around a vertical axis. The precision with which the ninth sheet of rays can be lined up with the limbi limits the error in the rotation of the head around a vertical axis to one degree of arc. The effect on splay and slope of rotating the head one degree around a vertical axis was determined to be negligible.

The forehead rest and chin cup eliminated translation in the fore and aft direction, and also eliminated rotation around a horizontal axis normal to the median sagittal plane.

Small rotations of the head around a horizontal axis in the median sagittal plane would have an effect on the slope angle but very little effect in the splay angle.

The splay asymmetry reported in Table 4 can be classified as anatomical.

The slope asymmetry could be associated with hypereye since the head was adjusted to bring the pupils to the same level, i.e., if the sagittal plane of the nose corresponded to the sagittal plane of the head.

The asymmetry for the distance from the pupillary center to the pad point is reported in Table 5. Fifteen of the 92 subjects revealed a 2 mm. or greater difference between the right and left values for this variable. Only 2 of these 15 subjects were females. Awareness of this type of asymmetry is important for proper placement of the optical centers of spectacle lenses before the eyes. It is also important in deter-

$$\tan \text{ (crest angle)} = \frac{\sin \text{ (slope angle)}}{\tan \text{ (splay angle)}}$$

The scattergram in Figure 8 shows the correlation between the computed values and the actual (measured) values for the crest angle. The coefficient of correlation computed from the data in Figure 8 was +0.27.

If we use the formula to compute a value for the crest angle from the average value for slope and the average value for splay (see Table 1),

$$\text{crest angle} = \text{arc tan} \frac{\sin 20.7^\circ}{\tan 22.7^\circ} = 40.2^\circ.$$

It is seen that the computed value (40.2°) conforms reasonably well with the average of the measured values (35.0°) given in Table 1.

In accordance with the equation the crest angle is correlated positively with slope and negatively with splay. Furthermore, slope and splay are correlated positively with each other. The correlation coefficients, however, are not very high (see Table 2).

As the corneal inset increases, one might expect the sides of the nose to be steeper, and thus find a negative correlation between splay and inset. The coefficient of correlation for this relationship was negative (–0.16) for males and slightly positive (+0.02) for females.

If a positive correlation were to be found between interpupillary distance (P.D.) and the distance between pad points (D.B.P.), this would offer the advantage of limiting the number of combinations of

FIGURE 10

Scattergram Relating P.D. with D.B.P. for Female Subjects

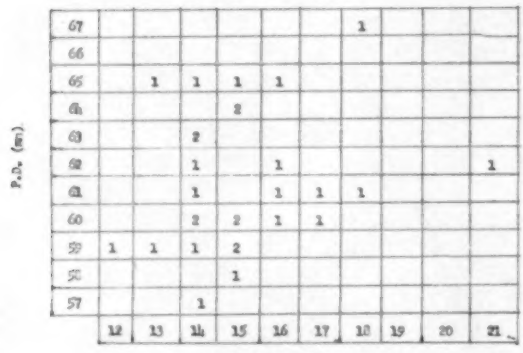



Fig. 10. Scattergram Relating P.D. with D.B.P. for Female Subjects.

# A NEW TEST FOR ASTIGMATISM — A PRELIMINARY REPORT*

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## INTRODUCTION

In 1827, George B. Airy, the astronomer, became the first to utilize a cylindrical lens for the correction of astigmatism on his own left eye.[1] Since that time, one of the more perplexing tasks remaining for the refractionist is the accurate determination of astigmatic error—in particular, the axis.

The charts used for obtaining these measurements are legion. Duke-Elder states,[2] "A very large number of such figures have been devised most of which have been derived from the ingenious and original work of John Green (1866-69), who used radiating lines, blocks of lines at right angles and acute angles, red and green lines and rotating dials to aid in determination of the strength and the direction of the axis of astigmatic errors."

The "sunburst" chart and rotating cross, commonly used in a projecting device, are the most frequently used of these derivations in measuring the direction and amount of astigmation.

However, these charts have their drawbacks in a clinical situation. In determining the axis on a "sunburst" dial, the lines must be so sparse to prevent confusion that the accuracy can hardly be within ten degrees of error, especially with lower amounts of cylinder. Moreover, even though the number of lines is small, the refractionist will find that patients experience some confusion in using this chart although a pointing device minimizes this considerably. Even when the refractionist's questioning is carefully stated and the device is at its simplest he will receive replies that, for example, the top half, or right half of a rotating cross is blackest: or when the cross is off-axis, the right or left hand line is darker. The Jackson cross-cylinder, while a very useful test, can be extremely confusing—as the refractionist who has self-tested the procedure will agree.

The purposes of this paper are to describe, first: a new, highly accurate method of cylindrical axis determination, and second: to unify this method into a total program of astigmatism testing procedure.

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mining the correct inset values for the right and left segments in the case of multifocal lenses.

ACKNOWLEDGMENT

The author wishes to express his gratitude to Professor Glenn A. Fry for his guidance in this study.

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## IN MEMORIAM

Anno Domini

1961

Dr. Alexander E. Allen, Bakersfield, California

Dr. E. E. Brann, Independence, Kansas

Dr. T. E. Holleman, Winston Salem, North Carolina

Dr. Ralph S. Minor, Berkeley, California

Dr. Harold Neuwirth, Riveredge, New Jersey

Dr. John T. Peterson, Rockford, Illinois

Dr. S. Harold Roberts, Chicago, Illinois

Since our last meeting, I regret to report that the Academy has lost seven members through death. Each of these optometrists played a significant part in the development of the profession, and each has left an important mark upon optometry. All have been active in the Academy. We miss these important leaders and the membership of the Academy at this time pays tribute to their memory.

(From the minutes of the 1961 Chicago, Illinois, meeting of the Academy.)

brated in degree of rotation, could be simultaneously and independently superimposed on the rotating streak image, the axis of astigmatism could be determined.

It has been found, however, that a second refinement increases the sensitivity of the test further. If the projection dial is modified to project two spots of light, equidistant from the center of rotation of the dial, the astigmatic individual will perceive two streaks of light. These streaks will remain commonly parallel as the dial is rotated, and they will revolve into either more or less of a vernier alignment as the dial is changed (Figure 1). Adler states,[4] "the precision with which we can

Fig. 1. (a) Projected light spots as seen in absence of astigmia: (b) light streaks as seen in astigmia, and (c) calibrated rotation of apertures until streak alignment obtained, giving axis of cylindrical correction.

adjust a mark on a Vernier scale depends on the aligning power of the eye. It is found to be extraordinarily fine. A skilled observer can make readings on the scale with an average error of not more than 3 seconds of arc." It is this aligning power of the eye that provides an immediate and precise axis determination in using the test here described even with minimal amounts of astigmia. Most subjects with only 0.25 D. of astigmia (either natural or induced by a plus cylindrical lens) will instantly report that the revolving lights are not "perfect circles" and they are able to align the streaks without any difficulty. The use of different colored lights expedites this alignment, especially when the streaks overlap with higher amounts of astigmia.

Experimentally, a number of color and size combinations of stimulus and background have been employed. It has been found that best results are obtained when the projected spots are monochromatic to minimize chromatic aberration, one of them being yellow and the other one green in color.* They should be of high brilliance and the background illumination should be low. The optimum size of the

*For some reason, the perception of a radiating red streak is more difficult than when the streak is of another color.

LINEAR ALIGNMENT TEST

The physical result of an astigmatic optical system is a linear focus of a point image of light. All chart tests are based on this fact in that a line stimulus will become darker by "reduplication" when the line is properly coincident to the astigmatic axial direction. Lensometer devices are also based on this principle. It follows, then, that the simplest theoretical test of astigmatism would be a point source of light which would become imaged linearly, indicating the direction of the astigmatism.* In practice, however, due mainly to the aberrations of the eye, a small source of light becomes what might be termed a streak-smudge giving, in low amounts of astigmatism, only a general hint as to direction of its axis.

If a very small source of brilliant light is used, a naive observer will be unable to estimate an axial direction below 2.75 diopters of astigmatism. It has been found, however, that the basic principle is usable in refractive tests through certain refinements which provide a high degree of sensitivity for the clinical situation. These refinements enhance the threshold of judgment of linearity through the employment of the physiological bases of vernier acuity and the associated vernier aligning power of the eye.

The first refinement is one of the stimulus rotation. If the retinal image streak is moved about, a sensitometric increase in judgment of linearity and direction is found to occur. This rotation is best accomplished by a projection device which contains an aperture slightly eccentric to the rotation axis of a revolving dial. In this situation, the physical spot of light is seen, in astigmatism, as an isodirected streak moving in an arc equal to the eccentricity of the projection aperture. The linearity of the point source becomes more apparent to the astigmatic observer probably because, as the fixated light revolves, the "ends" of the streak image rapidly traverses many cones of the retinal mosaic. The stimulus movement, therefore, provides a type of vernier acuity which, being notably more sensitive than other resolving abilities of the visual process, enhances the perception of the streak image. In this situation, an observer with only 0.50 diopters, or less, of astigmia will readily detect the axial direction of the streak. Thus, if a projected line, cali-

*Donders recognized some value in this method. He wrote[3] "the patient should now be directed to look towards an opening of from 2 to 4 millimeters in diameter. [openings in a window pane were used] at a distance of from 10 to 15 feet, while by means of glasses we cause slight myopia to alternate with hypermetropia." He goes on to describe an "extension of the diffusion-image, * * * usually observed in two opposite directions, indicating the maximum and minimum of curvatures."

This dial section would have a movable peripheral pointer, coupled to the dial knob, for "roughing in" the astigmatic axis under fog.

If there are no indications of ciliary spasm, the fogging lenses are then removed (or reduced to 0.25 or 0.50) which will result in one principle meridian being in or very near focus while the other principle meridian lies in front of the retina. At this point of least fog and maximum contrast, the second dial is projected. This section contains the opposed apertures which, being coupled to the preceding dial, will present to the astigmatic individual two streaks fairly close to alignment. The dial is moved slightly back and forth and the questioning proceeds thusly:

> "Do you see the two bright lights? Do they appear to be round dots (no astigmatism) or do they seem to be streaks? Is the tail of the yellow streak pointing exactly toward the tail of the green streak making one line? Watch closely. I'm going to move the streaks in a circle and when they aim in the same direction in a perfect line with each other, or overlap, I want you to say 'now'."

It is notable that when vernier alignment is attained, the observer will respond with an emphatic and unhesitating report. "Chasing around the dial," as occurs with some astigmatism tests (especially the crossed-cylinder) does not occur. At this point the meridians of astigmatism have been established and the examiner places his refracting cylinder axis 90 degrees from the streak position (minus cylinder) for measurement of cylindrical strength.

The determination of amount of cylinder may be made on the aperture dial by adding cylinder in 0.25 D. steps until the observer reports the two lights as "round dots." However, since the linear alignment test is best accomplished with little or no fog, cylinder should not be added to the point of reversal because of accommodative effects. Major reliance upon cylinder amount should be placed, therefore, on the determinations made with the third dial section. This dial would consist of a right-angled "V," each line finely "herringboned" at right angles to itself. The "V," being coupled to the other dial sections, would automatically be in the proper position for measurements of cylinder strength in the normal manner.

A method of cylinder refraction similar to that described in this paper has been successfully used by the author on several hundred patients. Comparative evaluations, using known cylinder amounts at known axes, indicate that the linear alignment test is equal to or superior

spots is found to be about 7 mm. and they should be about 38 mm. apart.

THE PROJECTION SLIDE AND TECHNIQUE

Although the linear alignment test can be used by itself in astigmatism refraction, its practicality is often enhanced if it is used in conjunction with other tests. A description of the apparatus (Figure 2) and the basic method is given below.

(It is presumed that an adequate retinoscopy, initial red-green studies and, in some cases, preliminary cross-cylinder tests are accomplished first. The tentative cylinder is then removed.)

The astigmatic testing portion of a projection slide would ideally consist of three dial sections, all of them coupled for rotation to a dial knob registered in two degree intervals. The first section would consist of the top half of a sunburst dial. A red spot would be provided at the point of intersect of the radiating lines for fixation purposes.

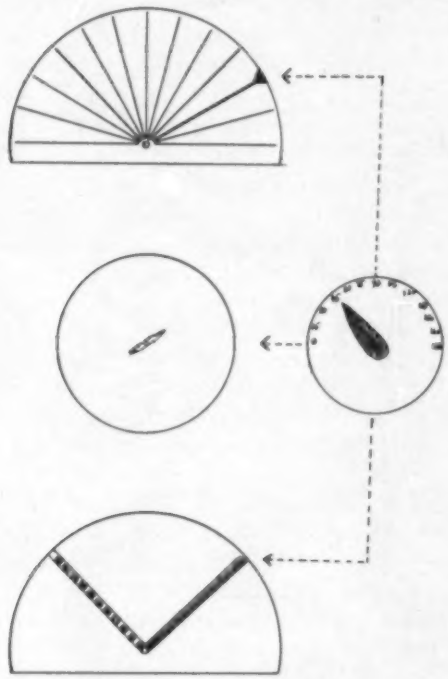

Fig. 2. An arrangement of astigmatism testing components for a projection slide using the linear alignment technique.

SPECIAL REPORT

# OPTOMETRY IN THE NAVY*

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## I. INTRODUCTION

Optometry's history in the armed forces, though relatively recent in origin, has not hitherto been recorded for posterity nor compared to other professions in order to determine its relative progress and to evaluate its present status.

Civilian practitioners, for the most part, are unaware of the role their profession plays in the military, and optometric students often are unfamiliar with the opportunities and the benefits derived from life in the service.

It is the purpose of this paper to provide information for the profession concerning optometry in the Navy.

## II. COMPARATIVE HISTORY

### *A. Medical*

Before the establishment of the Navy Department in 1798, medical history consisted of a narrative of the activities of a few medical doctors who served aboard ship attracted primarily by the lure of travel and adventure. Until 1801, a surgeon was simply appointed for duty aboard a certain ship, often by the captain on the spot, without further reference to any other authority.[1a] By 1803, it was common practice for the ship's captain to retain the same surgeon when he shifted his flag to a new command. However, when a ship was placed out of commission, the doctor had no further employment or pay in the Navy until he could secure a berth on another ship. At that time, an act of Congress made his position more permanent by providing for half pay while on leave between assignments.

The number of doctors allowed each ship and the pay scale were fixed by the number of guns the ship carried. Vessels mounting twenty

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The opinions or assertions contained herein are the private ones of the author, and are not to be construed as reflecting the views of the Navy Department or the naval service at large.

†Optometrist, M.S., Lt. MSC, USNR.

to other clinical methods. The comparative results will be published in a later paper.

CONCLUSIONS AND SUMMARY

A new test for astigmatism has been described and the theory and technique of its use has been explained. In clinical usage, the linear alignment test has been proven to be rapid, accurate and non-confusing.

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## ANNOUNCEMENT

### SOUTHWEST CONTACT LENS SOCIETY

Dr. Charles R. Stewart, president of the Southwest Contact Lens Society has called the next meeting of the group for March 17-20, 1962, at Oklahoma City, Oklahoma. The general program will present a number of speakers and the four day sessions will include 45 hours of special post-graduate courses dealing with contact lens fitting in keratoconus, aphakia, residual astigmatism and the problems of fitting these lenses for very young patients. The courses are open to all optometrists who are members of the A.O.A. Dr. Chester Pheiffer, College of Optometry, University of Houston, Houston, Texas, will be in charge of the post-graduate courses. Additional information may be had by writing Dr. Charles R. Stewart, 115 N. Seventh, Waco, Texas.

officers which was relieved somewhat by the inauguaration of the Navy V-12 general officers procurement and training program in 1943. This program provided the Medical Department with a continuous supply of medical officers through a system of college training under Navy auspices. The shortage was further alleviated by enrolling a number of scientists in spheres allied to medicine in the naval reserve.

After World War II the current authorized number of medical officers was established by act of Congress dated August 7, 1947. This act provided that the total authorized number of commissioned officers of the Medical Corps shall be sixty-five one hundreds of one per cent of the sum of the total authorized number of commissioned officers and men of the Navy and Marine Corps.[1d] Computations to determine this strength are made as of January first of each year by the Secretary of the Navy.

More recently, under authority of the Career Incentive Act of 1949, medical officers received incentive pay of $100 a month, exclusive of internship, in addition to their base pay and allowances. On May 1, 1956, this law was expanded to grant constructive service credit toward longevity pay and promotion for the four years which physicians spend in medical school and for the one year spent in internship. In addition, incentive pay was increased to $150 a month during the third to sixth year of active service, $200 a month during the seventh to tenth year, and $250 a month for those who have completed ten or more years of active service.[2] As a result, naval medical officers now come on active duty in the grade of full lieutenant.

*B. Dental*

Before 1840, the year which saw the establishment of the Baltimore College of Dental Surgery, medical schools had refused to provide facilities for dental instruction, and dentistry lacked authoritative recognition as an independent profession.[1e]

The earliest official acknowledgment of the need for dental treatment in the United States Navy appeared in the annual report of the Surgeon General in 1870, but no action was taken until March 3, 1883, when Congress appropriated $1,600 for the services of one dentist at the Naval Academy. He functioned in a non-naval status similar to the civilian members of the teaching faculty; yet this dental service provided for the midshipmen was the initial attempt to give dental care at government expense in the Navy. Previous to this and for several years later only urgent emergency dental treatments were provided by the medical officer at sea and in ports lacking civilian dentists. The character of the treatment was essentially inadequate and limited almost entirely to extractions.[1f]

or more guns were allowed a surgeon, those with fewer guns, a surgeon's mate whose rank was comparable to the present day warrant officer. In 1798 the surgeon's mates were advanced to the status of commissioned officers and the surgeon's pay was increased to fifty dollars per month plus the ever present possibility of prize money from captured English, French, and Barbary pirate vessels.

The medical assemblage in the naval service varied with the exigencies of the moment. In 1812, 26 medical doctors were on active duty, in 1815, their ranks swelled to 47, but ten years later, only 34 were serving. They were, as a whole, unorganized and had little, if any, relationship to one another.

The Bureau of Medicine and Surgery was created in 1842, at which time there were about one hundred and twenty medical doctors distributed in the grades of assistant surgeon, passed assistant surgeon, and surgeon. They had no rank, yet received from $950 to $2,700 per year depending on the character of their duties and the length of their service. These classifications were given relative rank during the 1850's, but it was of dubious merit inasmuch as there appeared to be very little agreement of opinion as to the definition of this status.[1b]

From 1871, the medical doctors were no longer listed simply as surgeons, but were placed in the same category as other staff corps officers with the grades of medical director, medical inspector, surgeon, passed assistant surgeon, and assistant surgeon, corresponding in rank to that of captain, commander, lieutenant commander, lieutenant, and master, respectively. The latter grade was changed to lieutenant, junior grade in 1884.[1c] Later, in 1899, legislation was passed which gave the rank of rear admiral to medical officers while serving as surgeon general.

Extensive reorganization was made possible by the expansion act of August 29, 1916, which provided the strength of the various Medical Department Corps were to be based on a ratio predicated on the combined strength of the Navy and Marine Corps personnel. The same legislation created the rank of rear admiral in the Medical Corps. Further changes were made in 1918 when, by order of the Secretary of the Navy, the Medical Corps, along with other staff corps of the Navy, were given the full military title of their rank. The old system of designating medical officers as medical director, medical inspector, surgeon, passed assistant surgeon, and assistant surgeon was abandoned.

As a result of the authorization of a two ocean Navy by Congress on July 19, 1940, the existing plans for medical support of naval forces had to be revised to conform with the hypothesis of a far flung globar war. The rapid build up which followed, created a shortage of medical

had completed more than five but less than twenty years service to lieutenant, and those who had completed twenty years service to lieutenant commander. The maximum number of lieutenant commanders permitted for the Dental Corps was, by this law, limited to ten.

At the outbreak of World War I, there were 41 dental officers on active duty; however, this number increased to 500 through expansion of the Dental Corps. It was amply demonstrated for the first time during this war that an adequate dental service has an essential function in the maintenance of the health and efficiency of the personnel of the Navy.

On July 1, 1918, Congress approved an act amending the laws pertaining to the Dental Corps, and authorized the pay and allowances of commander and captain, but not the actual ranks. This was another step in the direction of full recognition and equality with other staff officers of the Navy.

The removal of the limitation of the functional aspects of the dental service came in 1920 when the Surgeon General authorized prosthetic restorative treatment as a part of the professional sphere of the dental officer, and thereby elevated the dental service of the Navy to a status equal to that of civilian practice.

A school of dentistry was created in 1922 as a division of the U. S. Naval Medical School, and initially three dental officers were assigned post-graduate study to qualify as future instructors. The curriculum originally consisted of refresher courses and post-graduate work for older officers, and primary instruction for enlisted hospital corps dental technicians. However, the real objective of the dental school was, and has since continued to be, the indoctrination of the newly commissioned dental officer into the naval aspects of their profession. Concurrent with the above developments was the creation of a division of dentistry within the organization of the Bureau of Medicine and Surgery with a dental officer in charge. This division was given jurisdiction, under the direction of the Surgeon General, of all matters of dental significance, including personnel, material, and inspection.

On June 10, 1926, Congress passed an act which provided for the equalization of promotion of officers of the Navy staff corps with those of the line, opening the ranks of commander and captain to the officers of the dental corps. An attempt to create the rank of rear admiral for the dental corps failed to be approved. This recognition did not materialize until December 17, 1942.

From 1926 to 1932 was a period of continuous progress. New dental clinics and laboratories were established along with expansions

Shortly after the Surgeon General's report dated October 1, 1902, which recommended the employment of qualified dentists for the Navy, a bill was introduced in Congress to authorize employment of contract dentists for this purpose, but it failed to receive favorable consideration despite the fact that in 1901 Congress saw fit to authorize the employment of contract dental surgeons for the Army. Following this setback, provisions were made under the authority of the Navy Department to enlist graduate dentists as hospital stewards with the rating, pay, and allowances of a chief petty officer, for exclusive dental functions. Beginning in 1903, hospital stewards with a background in dentistry were put into a rudimentary dental service for all naval personnel ashore and afloat. Dental equipment and supplies were meager, and consequently only simple procedures and emergency treatment could be given.

A bill to create a dental corps failed congressional approval in 1904, but the struggle for proper recognition continued until an act of Congress dated August 22, 1912, established the U. S. Naval Dental Corps providing the first concrete public recognition of dentistry as a professional science.[18] The act provided for the appointment of dental surgeons to be part of the Medical Department of the Navy, but failed to specifically establish these appointees as the Navy Dental Corps. It stipulated drastic limitations in the number, rank, and professional activities of dental officers. There were to be no more than thirty dental surgeons, their rank was to be limited to that of lieutenant, junior grade, and their professional activities to consist only of those measures which would most effectively and economically preserve the teeth of the personnel and insure physical fitness. Prosthetic procedures and restorations, such as bridges or gold crowns, were not considered as part of the functions of a dental officer. Despite these limitations, it was required that a candidate for appointment as a dental surgeon should be trained in all branches of dentistry, and to be appointed he was required to complete examinations, both written and oral. He was also required to take both practical and clinical examinations in operative and prosthetic procedures.

In 1913, Congress passed legislation authorizing the establishment of a Naval Dental Reserve Corps, and in 1916, Congress passed an act authorizing the president to appoint and commission dental surgeons at the rate of one for each 1,000 of the authorized enlisted strength of the Navy and Marine Corps. This act specifically established the Dental Corps as a component of the Medical Department, but apart from the Medical Corps. It also provided for promotions of dental surgeons who

on active duty received an additional one hundred dollars monthly, and on June 30, 1953, the number of recipient dentists were recorded at 1,886. In 1956, public law 497 granted constructive service credit toward longevity pay and promotion for the four years dentists spend in dental school, and an increase in incentive pay to $150 a month during the third to sixth year of active duty, $200 a month during the seventh to tenth years, and $250 a month for those who have completed ten or more years of active service.[2]

A dental intern program which offers a year of special opportunities for clinical experience and advance training in dental science and practice beyond the undergraduate level is now available. Six months of the training is provided at the U. S. Naval Dental School, and an additional six months of training at one of seven teaching hospitals. Dental residency training is provided for dental officers seeking additional training in a particular speciality. Such special training includes oral surgery, prosthodontia, oral pathology, and periodontia. In addition, dental officers are granted refresher courses as well as post-graduate courses. These courses are authorized at leading civilian universities, and at the U. S. Naval Dental School. Special courses of six months duration in oral surgery and prosthodontia are available at the Naval Dental School to all career dental officers. Also available to the career dental officer are specialized courses in dental research.

III. OPTOMETRIC HISTORY

For years eye care was kept at a minimum in the Navy by the maintenance of high physical standards and selective procurement of personnel. Hence, the primary responsibility of the Medical Department in the ocular area was the treatment of eye diseases and eye injuries. This policy was in effect as late as November, 1938, as evidenced by the visual standards recorded in the Manual of the Medical Department.[3] Here it was stated that applicants for enlistment must have a minimum vision of 15/20 (20/27) in each eye correctable to 20/20 and no organic disease be present. Gun pointers and coincidence range finder operators needed 20/15 in one eye, and 20/20 in the other; while spotters and stereoscopic range finder operators were required to have no less than 20/20 and preferably 20/15 in each eye. For a commission, the standards in the Navy and Marine Corps were not less than 18/20 (20/22) capable of correction by lenses to 20/20 in each eye. In the staff corps, not less than 12/20 (20/33) in each eye, capable of correction to 20/20. Candidates for the Naval Academy and aviation cadets had to possess 20/20 in each eye. Therefore, most naval personnel were visually able to perform duty as required in their respec-

in other facilities both ashore and afloat. Post-graduate work at the U. S. Naval Dental School and civilian institutions received encouragement, although naval dental research was not at this time officially recognized or supported.

The first time a dental officer had assumed direct command of a naval unit was in 1936, when the Naval Dental School was added to the Naval Medical Center as a separate command headed by a dental officer.

A vigorious research program was instituted in 1939 as the result of increased responsibilities and the need for specialization covering every aspect related to dental science. Post-graduate courses in practically all dental specialities were made available in many of the leading schools throughout the country. This far-sighted program provided educational opportunities, and in 1943, 1,500 dental officers were procured through the V-12 plan which assured an adequate supply of officer personnel to the Navy in all classifications. Then on the first of June, the same year, the dental requirements for inductees in the Navy were reduced to the level of Army standards.[1h] Certain correctable dental defects were waived resulting in an enormous increase of the already heavy work load at all Navy and Marine Corps reception centers. This required further expansion of all dental facilities to a maximum degree utilizing 7,000 dental corps officers in World War II to provide dental service not only ashore, but on all ships larger than a destroyer. In addition, dental officers performed important functions in connection with rendering first aid to the wounded, and in the collection and evacuation of casualties.

Closely following the period of demobilization, plans were instituted for a broad program of education designed to advance the professional standards of the Naval Dental Corps. Subsequently, a dental branch was created in 1945 to function within the Medical Department research division. However, the pinnacle of success was not reached until the Surgeon General issued a directive on August 20, 1946, which established an autonomous division of dentistry within the Medical Department of the Navy. The profession's position was strengthened in March, 1947, when the office of General Inspector, Dental, was created, and again later in the same year when the dental clinic of Washington, D. C., was established as an independent entity with a dental officer in command. As a result, the Dental Corps now enjoys the official status and prestige of the other Navy staff corps.

Under authority of the Career Incentive Act of 1949, dental officers

exchange. In the interim, the Medical Department, with the assistance of the pioneer optometrists, began to establish an optical program by utilizing men inducted into the military service who were dispensers and opticians in civilian life. Some money was provided locally through the use of welfare funds, and the beginning of a visual program was instituted. For the first time, the results of every refraction were recorded in each man's health record and signed by the examining practitioner.

The Navy ophthalmic program[4] became effective as of July 1, 1949, providing personnel of the Navy and Marine Corps with new spectacles, when required, at government expense. Lenses and frames were authorized as replacements for those lost or damaged in the performance of duty. The original prescription, the repair, and the replacement service was signed for by the refractionist. The need for this service was based on the serviceman's use of spectacles in the performance of his official duties. There were neither visual acuity standards nor limits of dioptral correction imposed on the refractionist as a basis of issue, and it was the responsibility of the examiner to determine whether or not low errors of refraction were of such a nature as to justify the wearing of spectacles.[5] If necessary, two pairs of spectacles were issued at the discretion of the refractionist; however these were not to be prescribed indiscriminately.

Throughout naval history visual requirements have been raised or lowered to meet the needs of the military service, and in 1952 the standards of minimum visual acuity requirements for procurement of personnel for the Navy were listed as follows in the Manual of the Medical Department.[6a] Officer training programs such as the naval academy and aviation cadet required 20/20, commissioned officer appointment in the line, deck, or ordinance 20/40 correctable to 20/20, warrant officer or staff corps 20/100 correctable to 20/20 and Marine Corps 20/30 correctable to 20/20. For enlistment and reenlistment in the Navy and Marine Corps there are three categories: E-1 which consists of men with 20/70 in each eye correctable to 20/20 in one eye and 20/30 in the other, E-2 which consists of men with 20/200 in each eye correctable to 20/40 in each eye, and E-3 which consists of men with 20/400 in each eye correctable to 20/40 in one eye and 20/70 in the other, or 20/30 in one eye and 20/100 in the other, or 20/20 in one eye and 20/400 in the other. Women, Navy and Marine Corps, need 20/200 in each eye correctable to 20/20. Hence, it is obvious that a large number of active duty personnel are in need of and require optometric care in order to meet and maintain the existing visual standards.

tive assignments, and the need for optometric services was not apparent. In addition, the absence of any provisions of law whereby members of the professions allied to medicine could be commissioned in the regular Navy, in ranks comensurate with their education and professional attainments, precluded the employment of such skilled personnel. Later, in 1940, the state of world affairs caused our government to expand the armed forces, and create the national manpower draft which increased the number of applicants interested in naval service. It was during this expansion that a law was enacted to provide commissioned ranks in the reserve component of the hospital corps for allied science personnel. A number of scientists in spheres allied to medicine were enrolled in the naval reserve to function as adjuncts of the Medical Department, and to alleviate the shortage of medical corps personnel. Optometrists were included and commissioned in what was known as the Hospital Specialists Corps (Reserve). The records indicate that the following men were the pioneers in this field, and deserve special mention for the part they played in the establishment of Optometry as a profession in the Navy.

| *Name* | *Rank* | *Date of Rank* |
|---|---|---|
| Coops, Ralph E. | Lieutenant | April 1, 1941 |
| Euler, Arthur E. | Lieutenant | May 19, 1941 |
| Mooney, Frederick P. | Lieutenant, Junior Grade | May 24, 1941 |
| Bird, George T. | Lieutenant, Junior Grade | June 18, 1941 |
| Steve, John H. | Lieutenant, Junior Grade | June 26, 1941 |
| Jacobson, James J. | Ensign | April 19, 1941 |
| Jenks, Frederick C., Jr. | Ensign | May 19, 1941 |
| McDonald, Charles J. | Ensign | June 7, 1941 |

Parenthetically, it may be stated that many optometrists obtained commissions in other branches of the Navy or Marine Corps, and served their country honorably during World War II after which they transferred to the Optometry Division of the Medical Service Corps, or returned to civilian practice.

As late as 1941, no provision was made by the Navy for the procurement of spectacles and if a refraction resulted in the prescription of lenses, the individual examined was given his Rx to have filled wherever he chose. Many of these prescriptions were never utilized as intended due to financial reasons, for at that time a new recruit was paid only 21 dollars a month. It was not until 1942, that an act of Congress increased the seaman's pay to 50 dollars a month, and arrangements were made for the purchase of spectacles through the Navy

vided opportunities to warrant officers of the hospital corps for promotion to commissioned ranks and assignment to high level administrative positions in all Medical Department activities.

Public law 337, approved August 4, 1947, established the Medical Service Corps in the Navy,[7] and provided its authorized strength to be equal to twenty per cent of the authorized strength of the Medical Corps. As originally enacted and administered, the Medical Service Corps was composed of four sections. The administration and supply section constituted sixty per cent of the corps' strength, the medical allied sciences section twenty-five per cent, the optometry section five per cent, and the pharmacy section ten percent.[1j] As a result of this legislation, optometry emerged as a recognized section of the Medical Service Corps separate from the other allied scientists holding academic degrees in such fields as psychology, physiology, bacteriology, parasitology, entomology, chemistry, and physics. The optometric section currently (1960) is composed of 47 optometrists on active duty. Of this number 33 are regular Navy and 14 are reserve officers. In addition, there are approximately 138 optometrists on the inactive list holding reserve commissions in civilian life.[8]

IV. DUTIES OF THE OPTOMETRIST

*A. Professional*

Since civilians are generally unfamiliar with procedures, forms, orders, and instructions that are used in the Navy, appointees in the Medical Service Corps, in so far as practicable, are given a course of instruction and indoctrination prior to assignment to their first duty station.[6b] On duty, the optometrist can expect to conduct external examination of the eyes and their appendages, measure visual acuity, determine oculomotor defects, reveal refractive errors, prescribe appropriate lenses and/or prisms therefor, and render such other attention or treatment as may be delegated to him.

As the result of the information derived from the history, complaints, refraction, external and internal ocular examination of the patient, it is the optometrist's function to inform the medical officer of those patients in whom he may either discover or suspect pathology, those with abnormal conditions, and those who may require medical or surgical treatment.

The optometrist should make appropriate entries, relative to optometric examinations and treatments, in the clinical and health records of the patients he examines, and sign his name and rank to such entries.[9a] He also signs his own prescriptions for corrective lenses, prisms, and orthoptic training. In addition, he has immediate supervi-

Experience gained early in World War II demonstrated that there were many managerial and professional medical department functions which could be assumed by personnel educated and trained in pursuits other than medicine.[11] This need became more apparent as the unprecidented growth of the Navy caused visual requirements to be lowered in order to provide the necessary recruits for rapid expansion. Many optometrists and other scientists in fields allied to medicine were enrolled in the hospital corps reserve component in specialist classifications. Optometry grew proportionately to serve the visual needs of an expanded wartime Navy, and on March 29, 1945, there were seven lieutenant commanders, 12 lieutenants, 39 lieutenants, junior grade, and 32 ensigns for a total of 90 commissioned optometrists on active duty. One of this number, Raymond R. Sullivan, became head of naval optometry, and later was the first optometrist in the Medical Service Corps to be promoted to the rank of captain, which is the highest grade authorized by the enabling legislation.

The commissioning of optometrists was on a temporary basis in the naval reserve, and served as an expedient for the Navy. To secure a more desirable policy in regard to the commissioning of its members, Dr. Joseph M. Babcock, through the American Optometric Association, prevailed upon Congressman Short of Missouri to introduce a bill to establish an Optometry Corps in the Army. Sufficient evidence was presented to win its passage through both the House of Representatives and the Senate, and in 1945, the bill went to President Truman, who vetoed it. If acted upon favorably, this would have insured similar legislation for the Navy. However, World War II focused attention to the need of a permanent commissioned corps of specialists to provide the Medical Department with highly trained personnel in fields other than medicine and dentistry. The eightieth Congress received two bills from the Secretary of the Navy, one designed to establish commissioned grades in the hospital corps, and the other to create a medical allied scientists corps. These bills were considered by the armed services committee of the House of Representatives along with one designed to establish a Medical Service Corps in the Army. After prolonged studies and extensive hearings by this committee, it was decided to consolidate the three bills into one and make it applicable to both services. As a result, the three bills were modified to meet the needs of both services, and were combined into one law which is now known as the Army-Navy Medical Service Corps Act of 1947.[12] This legislation satisfied a long felt need for a permanent commissioned officer corps of professional personnel trained in the sciences allied to medicine. It also pro-

TABLE I.

Monthly Basic Pay*

Years of Service

| Rank | Under 2 | Over 2 | Over 3 | Over 4 | Over 6 | Over 8 | Over 10 | Over 12 | Over 14 | Over 16 | Over 18 | Over 20 | Over 22 | Over 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Captain | 592 | 628 | 670 | 670 | 670 | 670 | 670 | 670 | 690 | 800 | 840 | 860 | 910 | 985 |
| Commander | 474 | 503 | 540 | 540 | 540 | 540 | 560 | 590 | 630 | 680 | 720 | 745 | 775 | 775 |
| Lt. Commander | 400 | 424 | 455 | 455 | 465 | 485 | 520 | 550 | 570 | 610 | 630 | 630 | 630 | 630 |
| Lieutenant | 326 | 346 | 372 | 415 | 440 | 460 | 480 | 510 | 525 | 525 | 525 | 525 | 525 | 525 |
| Lieutenant (jg) | 259 | 291 | 360 | 370 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 |
| Ensign | 222 | 251 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 314 |

*Odd cents are not shown

TABLE IV.

Servicemen's and Veterans' Survivor Benefits Act Dependency and Indemnity Compensation for Widows*

Years of Active Military Service

| Pay Grade of Husband | Under 2 | Over 2 | Over 3 | Over 4 | Over 6 | Over 8 | Over 10 | Over 12 | Over 14 | Over 16 | Over 18 | Over 20 | Over 22 | Over 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Captain | 184 | 188 | 193 | 193 | 193 | 193 | 193 | 193 | 195 | 208 | 213 | 216 | 222 | 231 |
| Commander | 169 | 173 | 177 | 177 | 177 | 177 | 180 | 183 | 188 | 194 | 199 | 202 | 205 | 205 |
| Lt. Commander | 161 | 163 | 167 | 167 | 168 | 171 | 175 | 178 | 181 | 186 | 188 | 188 | 188 | 188 |
| Lieutenant | 152 | 154 | 157 | 162 | 165 | 168 | 170 | 174 | 175 | 175 | 175 | 175 | 175 | 175 |
| Lieutenant (jg) | 144 | 147 | 156 | 157 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 |
| Ensign | 139 | 143 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |

*Odd cents are not shown

sion of the services rendered by the optical unit, and may dispense lenses to any serviceman, active or retired, or delegate a competent subordinate to perform this function.

Optometrists are utilized to perform any auxiliary professional service that may be required in their speciality such as visual screening, visual skills, visual fields, subnormal vision, and contact lenses.

Optometry seeks to improve morale, decrease sick time, and increase productivity by providing more comfortable and efficient vision to the personnel of the Navy, and supplies professional services toward the solution of problems affecting eye safety, visual health, and visual acuity.

*B. General*

As naval officers, optometrists are directed to perform certain collateral duties where they serve as members of courts, boards, or committees which may be assigned to them. As members of eye-hazard safety committees, optometrists can, through indoctrination and by means of inspections, reports, and recommendations, attempt to decrease the hazards of eye injuries which threaten the safety of military and civilian personnel of the Naval Establishment.

Optometrists may develop and/or recommend standards in their special fields of endeavor, and make appropriate recommendations with regard to the needs of the Navy in the activities in which they are engaged.

Optometrists are authorized to assist medical and dental officers in the care and treatment of the sick and injured, and with their transportation in the field.[9c] They frequently conduct military inspections, and serve in the capacity of officer of the day. Hence, each optometric officer must keep informed of regulations, policies, and instructions pertaining to their duties and the facilities where they are stationed.

V. QUALIFICATIONS FOR A COMMISSION

Optometrists are commissioned under the provisions of the Army-Navy Medical Service Corps Act of 1947 which established the Medical Service Corps as a staff corps within the Medical Department of the Navy. It consists of officers in the grades of ensign to captain inclusive. Officers in the optometry section of the Medical Service Corps are procured from civilian life. Applicants must be graduates of accredited schools of Optometry, and must have received a license to practice as the result of successfully completing a state board examination.

Original appointments in optometry are normally made in the grade of ensign; however, the Surgeon General may approve original appointment in the rank of lieutenant, junior grade, in the case of applicants having a doctorate (Ph.D.) in his specialty.[9b]

is entitled to thirty days annual leave with pay. This is based on two and one-half days per month of active duty.

Insofar as service requirements permit, naval personnel are afforded the opportunity and are encouraged to take leave annually as it occurs. However, it is possible for an optometrist to accumulate unused leave during his tour of active duty. If he is released or retired from the Navy, this accrued leave is compensable in a lump sum payment not to exceed sixty day's basic pay and allowances.

Sick leave is leave granted to a person while under medical care and treatment and shall be considered to be a part of the period of care and treatment.[13] There are no special restrictions on sick leave accumulation, and it is not chargeable against earned leave.[14a]

C. *Educational Opportunities*

Officers of the optometry section of the Medical Service Corps are required to avail themselves of opportunities to enhance their professional abilities and to enlarge their usefulness to the Navy. They must keep themselves informed in all phases of and advances in their specialty, and its relation to the needs of the Navy. They are obligated to attend professional meetings of learned societies whenever practicable, and should take advantage of seminars, clinics, study courses, or similar means of acquiring additional knowledge.[6e] Generally, optometric officers are authorized time off from duty, not to be counted as leave, in order to attend the annual national and state optometric conventions, and the American Academy of Optometry meetings with the post-graduate courses.

The officer correspondence course program makes available to the naval optometrists on active or inactive duty courses in various naval subjects which are designed as self-study media to assist officers in improving their professional naval qualifications and in broadening their general knowledge of naval subjects.[15] These courses are available primarily through the U. S. Naval Correspondence Course Center, and the U. S. Naval Medical School.

Books on many subjects are available at the base library, and the information and education officer can, through the U. S. Armed Forces Institute, provide correspondence courses offered by participating colleges to uniformed personnel. Following enrollment, all correspondence takes place directly between the serviceman and the college or university.[10b] A college instructor grades each lesson and the end-of-course examinations. Hence, the educational opportunities are many and varied, but the individual must initiate them.

An appointee must be a citizen of the United States between the ages of 21 and 32, must pass a thorough physical examination, and must establish his mental, moral, and professional qualifications to the satisfaction of the Secretary of the Navy.[6d]

VI. COMPENSATION AND BENEFITS

*A. Pay*

An optometric officer's pay is primarily based on his rank, but is influenced by his length of service and his dependents. His monthly basic pay for his grade is figured on cumulative years of service, both active and inactive and is shown in Table I.[10a] The pay of each commissioned officer is periodically increased at a flat rate. These increases cease in each rank when it is reasonably expected that the individual should have advanced to a higher grade.[11]

According to the Officer Personnel Act of 1947 and to the Officer Promotion Plans of the Navy, the promotion rate for the foreseeable future will be about that shown in Table II.[12a]

TABLE II.

Promotion

| | |
|---|---|
| Ensign to Lieutenant (jg) | 18 months |
| Lieutenant (jg) to Lieutenant | 3-4 years |
| Lieutenant to Lt. Commander | 4-6 years |
| Lt. Commander to Commander | 4-6 years |
| Commander to Captain | 5-7 years |

In addition to base pay, all officers on active duty receive a subsistence and a quarters allowance as shown in Table III.[10a] It is to be

TABLE III.

| Rank | Subsistence Allowance | Quarters Allowance—With Dependents | Quarters Allowance—Without Dependents |
|---|---|---|---|
| Captain | 47.88 | 136.80 | 119.70 |
| Commander | 47.88 | 136.80 | 102.60 |
| Lt. Commander | 47.88 | 119.70 | 94.20 |
| Lieutenant | 47.88 | 102.60 | 85.50 |
| Lieutenant (jg) | 47.88 | 94.20 | 77.10 |
| Ensign | 47.88 | 85.50 | 68.40 |

noted that the subsistence allowance remains the same regardless of rank, and with or without dependents, but the quarters allowance is increased for officers with dependents. These allowances are not subject to federal income tax.

*B. Leave*

Leave is the authorized absence of an individual from a place of duty, chargeable against such individual in accordance with the Armed Forces Leave Act of 1946, as amended.[13] A naval optometric officer

ment has been met, all active duty, as a commissioned officer, warrant officer, or enlisted man in the Navy, Marine Corps, Army, Air Force, or Coast Guard or in the reserve components thereof is creditable.

Retired personnel are accorded the privileges of commissary stores, small stores, service clubs, and armed service exchanges subject to the limitation of available facilities. On the same basis they and their dependents receive hospitalization, in-patient and out-patient treatment at medical facilities.

All retired officers are required to report their address annually on the first of January to the commandant of the naval district in which they reside. They may be ordered to active duty in time of war or national emergency at the descretion of the Secretary of the Navy, but may be ordered to active duty in time of peace only with their own consent. Retired personnel are subject to the regulations of the Secretary of the Navy and to the Uniform Code of Military Justice.[18]

*E. Medical and Dental Care*

For many years the various services have provided medical care to military dependents on an "available" basis. However, because of distance, overtaxed facilities, or because the necessary treatment was not available, about 40 per cent of all service dependents did not receive medical care except at their own expense.[19a] In order to improve morale by providing better care for dependents and to establish a uniform level of medical care for all military services, the Dependents' Medical Care Act of 1956 was passed by the eighty-fourth Congress as Public Law 569.[10c] This law continued the practice of offering medical care to dependents and retired personnel at service medical facilities, and in addition permitted them to obtain available medical care at any medical facility of the Army, Navy, Air Force, or Public Health Service. The law also provides medical care through civilian medical facilities for spouses and children of active duty personnel who do not have access to service medical facilities, and permits retired personnel to obtain dental care at facilities of the uniformed services.

Local military commanders decide which areas will be serviced by each military medical facility, including zones in which dependents may have a choice of facilities. It is expected that dependents requesting care at a military medical facility will use the facilities servicing the area in which the dependent resides.

The care provided in civilian medical facilities will, for practical purposes, be the same as that available in service medical facilities, except for the exclusion of normal out-patient care.[19b] In either case, the fol-

*D. Retirement*

Optometric officers come under the general provisions governing non-disability retirement of permanent and temporary officers of the regular Navy with more than twenty years' active service. Normally, this will apply only to officers in the grades of lieutenant commander and above, because officers who are physically fit and perform duty satisfactorily are generally promoted through the first three commissioned ranks before becoming eligible for non-disability retirement. Hence, consideration will be given only to the ranks of captain, commander, and lieutenant commander.

Each captain of the staff corps, if not on a promotion list and if not selected for continuation on the active list, shall be retired on the first day of July immediately following the fiscal year in which he completes thirty years' total commissioned service and is considered as having twice failed of selection for promotion to flag rank or completes thirty-one years' total commissioned service.[16]

Each commander, if not on a promotion list and is considered as having twice failed of selection for promotion to the grade of captain, shall be retired on the first day of July immediately following the fiscal year in which he completes twenty-six years' total commissioned service.[16]

Each lieutenant commander, if not on a promotion list and is considered as having twice failed of selection for promotion to the grade of commander, shall be retired on the first day of July following the fiscal year in which he completes twenty years' total commissioned service.[16]

In accordance with statutory age requirements, each officer below the rank of fleet admiral shall be transferred to the retired list on the first day of the month following the date on which he attains the age of sixty-two.[17] However, the president may defer the retirement of not more then ten officers on active duty, but not longer than their sixty-fourth birthday.

As a general rule, an officer is retired in the grade in which he was serving at the time of retirement. If he served previously in a higher grade than that held at the time of retirement and his service in such grade was satisfactory, he will, subsequent to retirement, be advanced on the retired list to the higher grade. His pay will be figured as 2½ % times the number of years creditable for basic pay purposes times the applicable basic pay of the rank in which retired.[18] The retired pay may not exceed seventy-five per cent of the applicable basic pay. In determining whether the active service requirement for voluntary retire-

payment will not be less than $800 or more than $3,000, and is an amount equal to six months' basic pay plus special and incentive pays at the rank which the deceased member was entitled on the date of his death.[12b] The six months' gratuity is not subject to federal income tax. It is paid not only to survivors of those servicemen dying on active duty, but also to survivors of servicemen who die within 120 days after discharge or separation provided death results from a service-connected disability. Compensation for the widow, until death or remarriage, is $112 per month plus twelve per cent of the service member's monthly basic pay. This amount is figured for the ranks of ensign through captain and presented in Table IV. Compensation for children, where there is no eligible widow, will be 70 dollars for one child, 100 dollars for two children, 130 dollars for three children, and 25 dollars for each additional child. Payment of compensation for support of a child normally stops when the child becomes 18, but may be continued to age 21 if the child is in school. Page 699.

Survivor benefits for dependent parents are based on the parents' income, and provide a maximum of 100 dollars for two people and 75 dollars for one person.

A special Veterans Administration benefit of 35 dollars per month is payable to children between the ages of 18 and 21 who are attending a school or college approved by the Veterans Administration. This benefit is paid concurrently with the dependency and indemnity compensation, and is intended to take care of children not otherwise covered by social security payments which stop when children reach an age of eighteen. A widow with children under the age of eighteen will not be entitled to benefits from the Veterans Administration on behalf of the children. Benefits for these children will be paid by social security.

Officers on active duty are eligible to apply for membership in the Navy Mutual Aid Association which provides the beneficiary a guaranteed benefit of $7,500 plus a terminal dividend of $2,000. This membership includes the processing of all survivors' claims before government agencies, provides storage for valuable documents, supplies photostats at any time, and maintains an emergency loan service up to the full cash value of the individual's policy.

*H. Social Security*

On January 1, 1957, members of the Armed Forces and their dependents were eligible for the benefits provided by the Old Age and Survivor Insurance program of the Social Security system on a permanent, contributory basis.[12c] At the inception of this program, service

lowing devices are not ordinarily authorized for dependents: artificial limbs, artificial eyes, hearing aids, orthopedic footwear, and spectacles.

Eligible dependents are not authorized dental care at civilian facilities (except as a necessary adjunct to medical or surgical treatment), but emergency care to relieve pain or suffering is provided at dental facilities of the uniformed services. Routine dental care may be requested in "remote areas" or overseas where civilian facilities are not available.

Complete medical and dental care is provided to all active duty personnel in the United States and overseas.

*F. Exchange and Commissary Privileges*

Exchanges sell at reasonable prices articles of necessity or convenience not supplied by the Navy.[14b] They are maintained at the majority of stations ashore and afloat for the benefit of servicemen and their dependents.

Commissaries sell food and other commodities at the lowest prices possible for the benefit of naval personnel and dependents, and are usually operated at the larger naval installations.[10c]

The other armed forces, particularly where no naval facility is available, extend to naval personnel and dependents the privilege of making purchases at their commissaries and exchanges.

When buying at Navy exchanges and commissaries, it is required that the items bought are not resold, either at a profit or loss, to unauthorized persons. Whatever is bought must be for personal use of the serviceman or his dependents, or for use as a bona fide gift.

*G. Insurance*

During World War II, National Service Life Insurance was offered to all military personnel by the United States Government. It was the only life insurance procurable that provided complete protection in all eventualities. After World War II, this insurance was made convertible to ordinary life, twenty or thirty year payment life, or to an endowment.

In 1951, the Servicemen's Indemnity and Insurance Act was passed which prohibited further issuance of National Service Life Insurance to personnel on active duty (although men already having this insurance could retain it), and provided for a free indemnity in the maximum amount of $10,000 for all servicemen.[20] This free government insurance was terminated with the enactment of the Servicemen's and Veteran's Survivor Benefits Act on January 1, 1957. This new law provided certain benefits for dependents of servicemen who died while on active duty. A six months' gratuity is payable upon receipt of certification of death and determination of eligible survivor. This

Social security provides a monthly income for a widow at age 62, or for a widow with children under age 18. Table VI gives the cate-

TABLE VI.

Social Security Survivor Benefits

Monthly Benefits Payable to Family in Event of Officer's Death

| Average Monthly Wage | Widow Only At Age 62 | Widow & Child Under 18 | Widow & 2 Children Under 18 | Widow & 3 or more Children Under 18 |
|---|---|---|---|---|
| 200.00 | 63.00 | 126.00 | 161.60 | 161.60 |
| 250.00 | 71.30 | 142.60 | 190.10 | 202.40 |
| 300.00 | 78.80 | 157.60 | 210.20 | 240.00 |
| 310.00 | 81.00 | 162.00 | 216.00 | 251.20 |
| 320.00 | 82.50 | 165.00 | 220.10 | 254.00 |
| 330.00 | 84.00 | 168.00 | 224.00 | 254.00 |
| 340.00 | 85.50 | 171.00 | 228.10 | 254.00 |
| 350.00 | 87.00 | 174.00 | 232.00 | 254.00 |
| 360.00 | 88.50 | 177.00 | 236.10 | 254.00 |
| 370.00 | 90.00 | 180.00 | 240.00 | 254.00 |
| 380.00 | 92.30 | 184.60 | 246.10 | 254.00 |
| 390.00 | 93.80 | 187.60 | 250.20 | 254.00 |
| 400.00 | 95.30 | 190.60 | 254.00 | 254.00 |

gories in which survivor benefits are paid based on the average monthly earnings of the deceased officer. In addition, a lump sum death payment is made to the widow, or to the person who pays the burial expenses. This figure is determined as three times the amount of the husband's monthly retirement benefit, but it cannot exceed $255.00.[22c] The application for a lump sum payment must ordinarily be made within two years after the officer's death.[22b]

Monthly retirement benefits are payable to the retired officer and his wife separately, or in several possible combinations. Table VII gives a detailed presentation of how retirement payments may be made based on the officer's average monthly wage.

The social security benefits for service members and their families are separate from, and in addition to, military retirement pay or any form of compensation benefits paid by the Veterans Administration.[19c] In addition, social security provides continuing protection in civilian life following retirement from the Navy, as old age benefits can be based on both years in the military service and years as a contributing civilian. In general, an officer needs a minimum of ten years coverage under social security in order to acquire a "fully insured status." This "status" is required to draw old age retirement payments at age sixty-five.

## VII. COMMENTS

Only that history concerned with the growth and development

personnel contributed 2¼ % of their base pay on the first $4,200 earned each year through payroll deductions. These deductions did not exceed $94.50 a year, and the government, as employer, paid an equal amount. Beginning January 1, 1959, withholdings were increased from 2¼ % to 2½ % causing a corresponding increase in the maximum amount subject to withholding from $4,200 to $4,800, and the maximum amount deducted was increased from $94.50 to $120.00. Effective January 1, 1960, social security taxes were raised from 2½ % to 3% leaving the amount subject to withholding at $4,800, but raising the maximum amount withheld from $120.00 to $144.00.[21] Table V

TABLE V.
Social Security Tax Deduction Rates
(per month)

| | Years of Service | | | | | | |
|---|---|---|---|---|---|---|---|
| | Under | Over | Over | Over | Over | Over | Over |
| Pay Grade | 2 | 2 | 3 | 4 | 6 | 8 | 10 |
| Captain | 17.78 | 18.84 | 20.10 | 20.10 | 20.10 | 20.10 | 20.10 |
| Commander | 14.23 | 15.09 | 16.20 | 16.20 | 16.20 | 16.20 | 16.80 |
| Lt. Commander | 12.00 | 12.72 | 13.65 | 13.65 | 13.95 | 14.55 | 15.60 |
| Lieutenant | 9.78 | 10.38 | 11.16 | 12.45 | 13.20 | 13.80 | 14.40 |
| Lieutenant (jg) | 7.78 | 8.73 | 10.80 | 11.10 | 11.40 | 11.40 | 11.40 |
| Ensign | 6.67 | 7.53 | 9.42 | 9.42 | 9.42 | 9.42 | 9.42 |
| | Over | Over | Over | Over | Over | Over | Over |
| Pay Grade | 12 | 14 | 16 | 18 | 20 | 22 | 26 |
| Captain | 20.10 | 20.70 | 24.00 | 25.20 | 25.80 | 27.30 | 29.55 |
| Commander | 17.70 | 18.90 | 20.40 | 21.60 | 22.35 | 23.25 | 23.25 |
| Lt. Commander | 16.50 | 17.10 | 18.30 | 18.90 | 18.90 | 18.90 | 18.90 |
| Lieutenant | 15.30 | 15.75 | 15.75 | 15.75 | 15.75 | 15.75 | 15.75 |
| Lieutenant (jg) | 11.40 | 11.40 | 11.40 | 11.40 | 11.40 | 11.40 | 11.40 |
| Ensign | 9.42 | 9.42 | 9.42 | 9.42 | 9.42 | 9.42 | 9.42 |

provides the optometric officer with the amount of tax at 3% per month that is deducted from his base pay for social security. This present tax rate is to continue until calendar year 1963, when it is scheduled to increase to 3½ %. In 1966, it is anticipated that a tax of 4% will be required to meet the program's obligations, and in 1969 a further increase to 4½ % is planned to maintain social security on a self-supporting basis.[22a]

The amount of social security benefits paid to retired individuals or survivors depends upon the average monthly earnings of the serviceman. These benefits are not paid automatically at age sixty-five or at death, but must be applied for by the individual or his survivors.[23]

Survivors insurance payments cannot commence until an application has been made, however back payments can be made if the application is not filed in the first month for which benefits are payable. These back payments cannot be authorized for more than twelve months.[22b]

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TABLE VII.

Social Security Retirement Benefits

Monthly Retirement Benefits Payable to Officer and Wife After Retirement in Addition to Retired Pay

| Average Monthly Wage | Officer's Benefit At Age 65 | Wife's Benefit If Started At Age 65 | Officer & Wife's Benefit Both Started At Age 65 | Wife's Benefit If Started At Age 62 | Officer & Wife's Benefit Officer 65 Wife Started At Age 62 |
|---|---|---|---|---|---|
| 200.00 | 84.00 | 42.00 | 126.00 | 31.50 | 115.50 |
| 250.00 | 95.00 | 47.50 | 142.50 | 35.70 | 130.70 |
| 300.00 | 105.00 | 52.50 | 157.50 | 39.40 | 144.40 |
| 310.00 | 108.00 | 54.00 | 162.00 | 40.50 | 148.50 |
| 320.00 | 110.00 | 55.00 | 165.00 | 41.30 | 151.30 |
| 330.00 | 112.00 | 56.00 | 168.00 | 42.00 | 154.00 |
| 340.00 | 114.00 | 57.00 | 171.00 | 42.80 | 156.80 |
| 350.00 | 116.00 | 58.00 | 174.00 | 43.50 | 159.50 |
| 360.00 | 118.00 | 59.00 | 177.00 | 44.30 | 162.30 |
| 370.00 | 120.00 | 60.00 | 180.00 | 45.00 | 165.00 |
| 380.00 | 123.00 | 61.50 | 184.50 | 46.20 | 169.20 |
| 390.00 | 125.00 | 62.50 | 187.50 | 46.90 | 171.90 |
| 400.00 | 127.00 | 63.50 | 190.50 | 47.70 | 174.70 |

of the professions was presented so that a basis for comparison could be established. In a relatively short period of time, Optometry has become commissioned and accepted as a vital part of the Navy's eye program. By its accomplishments Optometry has earned recognition as an important division of the Medical Service Corps, and in carrying out its assigned functions has effectively assisted in accomplishing the overall mission of the Medical Department of the Navy.

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(3) Initiating and supporting, in suitable centers and institutions, research programs in optometric subjects.

(4) The American Academy of Optometry fully realizes and willingly assumes its responsibilities of leadership in the field of Professional Optometry to the end that it will ever stand for those principles of high ethics, increased educational standards, and unselfish service to the public, as opposed to the forces of commercial agencies which seek to degrade every aspect of the profession.

That these principles may be accomplished in fact, the American Academy of Optometry has not only formulated, but is guided by a strict code of ethics. Furthermore, to assure continued maintenance of these standards, the Academy has adopted rigid entrance requirements.

Now some forty years later we may briefly examine the record to see just how the present membership, along with those fine Fellows who preceded us, have upheld these principles.

The first of these deals with affording members an opportunity for the presentation and discussion of results of clinical and experimental research dealing with visual problems. As is well known, this has been accomplished throughout the entire life of the Academy by means of the general programs at our Annual Meetings and through the special programs of many of our Chapters.

The second object deals with encouraging observation and reporting of exceptional and instructive conditions encountered in the practice of the individual Fellow. This took longer to get into full swing but our Sections for a number of years have been doing an exceptional job of carrying out this portion of the Academy program. In addition, our fine Post-Graduate and Home Study courses are more than pulling their weight. In all of these activities, the Academy Journal brings to a large segment of the profession this educational material.

The third portion deals with supplying research programs in centers of optometric learning. Here, too, both the Academy and its Chapters have been active. A larger membership would provide additional funds for the continuation of this important work.

The fourth object was to set practice standards for members and enforce them and by their example introduce these standards to the entire profession. How well this has succeeded is shown by comparing the number of ethical professional practitioners at the end of World War I with those of today. From a small minority in 1920 the number has grown until at this time only the exceptional practice fails to meet the high standards set by the Academy. To a very great extent, this splen-

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## THE PROGRAM OF THE ACADEMY*

Forty years ago in St. Louis, Missouri, the American Academy of Optometry approved and put into effect what is now article II of its Constitution dealing with the objects of the organization. These are:

The object of the American Academy of Optometry shall be to further the development of optometrical sciences in its efforts to conserve human vision by:

(1) Affording an opportunity for the presentation and discussion of the results of clinical and experimental research in visual problems.

(2) Encouraging the scientific observation and reporting of exceptional and instructive conditions encountered in the practice of the individual Fellow.

*Excerpts from the Annual Report of the Secretary, presented at Chicago, Illinois, December 9, 1961.

TRANSACTIONS OF THE
AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

# ANNUAL REPORT OF THE PRESIDENT*

Ralph E. Wick†
Rapid City, South Dakota

Welcome to the 41st gathering of the American Academy of Optometry. The growth and success of the Academy over the past few years reflects the maturity of our profession. This Academy devoted to research, education, and highest type of professional conduct has now taken its place among the great organizations of the world devoted to care and preservation of human vision.

We have just completed three days of outstanding post-graduate education under the direction of Vincent Ellerbrock. The caliber of instruction, the variety of courses and the enthusiasm of the students evident the last three days would in itself nearly justify the existence of the Academy.

Within a few minutes we will again embark on a four-day program that is the highlight of the optometric year. Under the direction of John Zettel as general program chairman with the assistance of Henry Peters, a truly outstanding program has been arranged. A new feature this year is the abstract which appears with each title on your program.

My report to the Academy might best be summarized by saying that the Academy is a way of thinking. Throughout this report of the past activities and of our future plans, you will find this way of thinking in great evidence.

In my acceptance speech last year in San Francisco, I stressed the challenge of Academy membership. I would now like to submit another challenge to Academy members. Throughout the last few years there has been increasing evidence of participation of Academy members in their state and national organizations. We encourage our members to participate in every way possible in all phases of organized op-

*Read before the annual meeting of the American Academy of Optometry, Chicago, Illinois, December 9, 1961. For publication in the December, 1961, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist, President, American Academy of Optometry.

did development is due to the early initial work of the Academy and to the training given undergraduate students in optometry in our schools and colleges. These courses in practice management were Academy planned in those early days when they were first given.

From this brief review it is evident that the Academy under the direction of those who preceded us and in the hands of the members today is fulfilling the objects of the organization. To be sure, more and better work in this field is planned for the future yet it is now safe to say that the effects of this work are being felt by optometrists and by the public wherever English is spoken and in more recent years in many other places as well. This is all to the good.

CAREL C. KOCH

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## CHRISTMAS GREETINGS

It is a real pleasure for those on the staff of this publication to again send our Greetings and best wishes to our readers for the finest possible holiday season. Optometry is just concluding another fine year and we all look to the future with confidence. We are thankful for our many successes. We extend to our friends in the Optical Industry and to optometrists everywhere the Season's greetings. A Merry Christmas and Happy New Year to you all.

THE EDITORIAL STAFF

---

*for Optometrists* has gone well into its second printing. A report of the progress of the second project of our Home Study Course Committee under the direction of Meredith Morgan will be presented during this meeting. One of the outgrowths of fellowship in the Academy has been the production of a symposium type textbook for optometry. The textbook on *Vision of the Aging Patient* was written by fifteen members of the Academy. We developed this first textbook so easily that a second on *Vision of Children* was undertaken. It is now well under way and will be published during the coming year. While this is not an official Academy program, it would not have been possible without the close association and understanding which exists among the fellows of the Academy.

Our official Journal also serves as the archives of the American Academy. As our journal it has set a standard of excellence equivalent to that of any professional journal. As the archives it keeps us informed of Academy activities throughout the year. As your President I receive copies of correspondence concerning individual articles, over-all reader balance of the issue, and the editorial program. Carel Koch's unusual administrative ability is present here as well as in the affairs of the Academy. They say you can judge how successful an administrator is by the worried look on the face of the assistant administrator. I haven't noticed how worried Monroe Hirsch looks lately, but I do know of the tremendous job he is doing as associate editor of the Journal. Our special thanks to Carel Koch, Monroe Hirsch and the staff of the Journal for their contributions to the Academy and the profession of optometry.

One of the sections of the Academy a few years ago undertook a project of certification. This is the active clinical section devoted to contact lenses under the direction of Bob Graham. We want to urge all of the Academy members who are doing any amount of contact lens work to qualify as Diplomates of the Contact Lens Section. This can be a valuable reference source within the profession of optometry and one very sorely needed in a rapidly expanding area such as contact lenses.

I want to take this opportunity to extend to all of you a personal invitation to plan now for the forthcoming meeting in Miami next year. This is the first time in Academy history we have held a meeting this far South. It promises to be one of the outstanding meetings in Academy history. The Florida Chapter started working on this program two years ago when we first accepted their invitation. The membership in Florida Chapter has greatly increased since that time. Visits have already been made to the convention hotel by members of the Florida

tometry. It is becoming obvious that urbanization of our country has resulted in creating of social problems in large communities which are different from those in small ones. Often our state and national leaders are from smaller communities which have entirely different problems from those existing in larger metropolitan areas. I particularly encourage Academy members who live in larger cities to take an active part in their state and national organizational meetings. It is only in this manner that the whole of optometry will be properly represented.

The Academy member also has an obligation at the local level to participate in Academy Chapter activities. The general get-togethers are valuable for any group, but more good clinical and educational meetings are needed. The Academy way of thinking can be of immense value in organizing this type of activity. Chapters also have a responsibility of interesting new men in their areas in Academy activities. Our Vice-President, Don Springer, is in charge of Chapter activities. He will be pleased to help you in organizing any type of program your Chapter wishes to undertake.

As your President, it was my privilege to attend the Long Term Planning Committee of the American Optometric Association in Chicago just a short time ago. The Long Term Planning Committee consists of representatives of various ancillary groups in Optometry. Among organizations represented were the A.O.A., the Academy, the Optometric Extension Program, the Association of Schools and Colleges, the International Association of Boards, and the Council on Optometric Education. The members of this committee are selected on the basis of their interests and possible contributions as well as the groups which they represent. The idea of representative optometrists gathering in one group in an unhurried atmosphere to discuss the present and future of the profession is a good one. It has been developed in other professions and in industry with considerable success. Perhaps the most interesting sidelight of this meeting to me as an individual was the sincere dedication of the leaders of all the various groups in optometry. There is a considerable difference, however, between educated concern and dedicated ignorance. Throughout this meeting ran a real evidence of educated concern with optometry's problems both of the present and of the future. The recommendations made to the Board of Trustees of the A.O.A. from these committees should serve as guidelines for both the immediate and distant future.

In keeping with the inquiring mind which is so much a part of the Academy way of thinking new optometric literature is making its appearance as a result of Academy activity. *The Synopsis of Glaucoma*

# VOLUME 38, 1961, GENERAL INDEX

This is an index covering all the departments of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY. The letters used to explain in which department the material indexed appears are as follows: (OP), Original Paper; (E), Editorial; (T), Transaction of Academy; (CC), Current Comments by Terry Judith Parkins; (SR), Special Reports; (C), Correspondence; (Ab), Abstracts; (BN), Book Notices; (A), Announcements, and (IR), Instrument Review.


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chapter and your officers. The Florida weather in December, the southern hospitality, and the hard working Florida Chapter can not help but to make this one of our outstanding meetings. Be sure not to miss this 1962 meeting.

How do you thank the members of your family for all they have done for you! As President, I am faced with much the same problem in trying to thank the Fellows of the Academy who have devoted so much of their time and effort during the year to make this program go. While I do not like to single out people for appreciation, there are certain men whose contribution is such that it must be mentioned. Vincent Ellerbrock as director of the post-graduate courses has had a continual organizational task since the time of the last Academy meeting and also a job of just plain detail work. John Zettel and Henry Peters have spent many hours and written hundreds of letters in the process of arranging the four-day session which is about to begin. The life blood of the Academy itself has kept flowing because of the activities of the examining committee under Harold Simmerman. Each of these men have their committees which have worked long and hard to make this program a success. My thanks to all of them.

Each year I have heard the president of the Academy thank our secretary, Carel Koch, for his work and devotion to the Academy. As an Academy member I always thought this was a nice recognition. As a member of the Executive Council for the past few years, I began to realize what they were talking about. As president, however, I can only state that one can not possibly realize the contribution this man is making to the Academy until you see him in action day in and day out in his job as secretary.

In the beginning I suggested that the Academy is a way of thinking. A recent issue of SCIENCE, the official publication of the American Association for the Advancement of Science, printed an article entitled, "Resistance by Scientists to Scientific Discovery." It stressed such points as the resistance to change found so often in the scientific mind, the psychological tendency to resist new ideas, and the comfort to be found in the status quo. In the next four days we will be exposed to many ideas and thoughts. Let's approach each paper with a scientific conservatism, but with an open mind willing to accept new ideas for improvement of vision.

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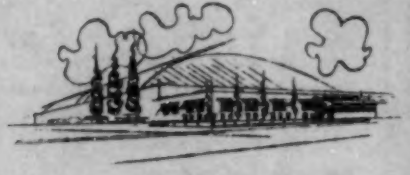

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